

W. B. No. 375.

Price 10 cents.

U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU.

METEOROLOGICAL CHART OF THE GREAT LAKES.

SUMMARY FOR THE SEASON OF 1906.

No. 2, 1906.

BY

ALFRED J. HENRY and NORMAN B. CONGER.

Prepared under direction of WILLIS L. MOORE, Chief U. S. Weather Bureau.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1907.

W. B. No. 375.

Price 10 cents.

U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU.

METEOROLOGICAL CHART OF THE GREAT LAKES.

SUMMARY FOR THE SEASON OF 1906.

No. 2, 1906.

BY

ALFRED J. HENRY and NORMAN B. CONGER.

Prepared under direction of WILLIS L. MOORE, Chief U. S. Weather Bureau.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.

1907.



Digitized by the Internet Archive
in 2015

<https://archive.org/details/meteorologicalch00unit>

STORMS AND HIGH WINDS IN THE LAKE REGION, 1906.

By ALFRED J. HENRY, Professor of Meteorology.

The Great Lakes were free from widespread and destructive storms during the season of 1906. The nearest approach to a storm of this character occurred on November 21, 1906, when a southwestern storm developed great energy over Lakes Michigan and Huron, and caused high southwest gales the next day over Lakes Erie and Ontario. Twelve vessels were damaged during this storm, of which number four, valued at \$150,000, became total losses.

The casualties due to heavy fog on June 15, 16, and 17 were especially numerous. The total loss and damage to vessel property during the season due to fog was over half a million dollars.

TABLE I.—Maximum wind velocities along the Great Lakes, season of navigation, 1906.

	April.			May.			June.			July.			August.			September.			October.			November.			Anemometer above ground.
	Velocity.	Direction.	Date.	Velocity.	Direction.	Date.	Velocity.	Direction.	Date.	Velocity.	Direction.	Date.	Velocity.	Direction.	Date.	Velocity.	Direction.	Date.	Velocity.	Direction.	Date.	Velocity.	Direction.	Date.	
LAKE SUPERIOR:	Mi.			Mi.			Mi.			Mi.			Mi.			Mi.			Mi.			Mi.			Ft.
Duluth.....	48	NW.	21	54	W.	18	48	NW.	21	48	NW.	21	38	NE.	23	40	SW.	25	50	NW.	27	48	NE.	26	47
Houghton.....	28	N.	14	36	NW.	4	25	N.	28	30	N.	25	32	NW.	29	28	W.	26	30	W.	8	29	W.	30	66
Marquette.....	36	W.	20	44	SW.	18	32	W.	7	35	W.	22	36	W.	29	45	NW.	13	40	NW.	27	42	E.	26	116
S. Ste. Marie...	29	NW.	30	38	NW.	4	23	SW.	9	36	NW.	21	38	NW.	29	37	NW.	29	38	NW.	28	43	W.	30	61
LAKE MICHIGAN:																									
Green Bay.....	38	N.	22	46	NE.	26	36	W.	6	36	W.	9	40	SE.	25	40	SW.	21	46	N.	29	50	N.	21	86
Milwaukee.....	30	SE.	24	42	SE.	8	36	SW.	7	32	NW.	22	34	SE.	17	32	NE.	30	42	E.	23	55	SE.	16	142
Chicago.....	40	S.	13	48	SW.	12	56	NW.	29	42	NW.	28	41	W.	9	46	N.	29	50	NW.	27	59	SW.	21	310
Escanaba.....	30	E.	8	40	W.	31	30	N.	10	32	W.	22	26	S.	2	46	W.	11	35	NW.	9	44	NE.	21	82
Grand Haven...	35	NW.	22	38	NW.	8	36	SW.	8	29	W.	20	28	SW.	29	27	W.	13	47	W.	7	64	SW.	21	92
LAKE HURON:																									
Alpena.....	40	E.	9	35	SW.	12	40	SW.	7	36	S.	15	25	E.	24	33	NW.	13	40	S.	8	46	SE.	17	92
Port Huron...	36	W.	14	45	W.	2	42	SW.	7	52	NW.	22	42	W.	4	36	NE.	30	46	NW.	27	48	SW.	21	120
DETROIT RIVER:																									
Detroit.....	42	SW.	13	38	SW.	8	39	W.	8	26	NE.	22	36	SW.	26	32	NE.	30	40	NW.	28	50	SW.	21	193
LAKE ERIE:																									
Toledo.....	40	SW.	13	36	W.	8	45	W.	8	40	SE.	13	41	S.	5	40	NE.	30	60	W.	27	68	SW.	21	246
Sandusky.....	39	NW.	22	33	NW.	2	31	W.	29	42	N.	22	32	W.	26	28	NE.	29	38	W.	27	32	SW.	21	70
Cleveland.....	52	NW.	22	48	NE.	28	45	W.	29	44	NW.	16	42	N.	27	48	N.	29	60	W.	27	52	SW.	21	201
Erie.....	48	S.	9	36	SW.	12	29	NW.	8	36	S.	8	30	SE.	25	30	S.	29	41	S.	27	35	SE.	18	102
Buffalo.....	40	SW.	14	48	SW.	12	55	NW.	8	30	SW.	29	41	W.	20	38	SW.	3	75	SW.	28	70	SW.	22	206
LAKE ONTARIO:																									
Oswego.....	31	SE.	9	28	W.	10	33	N.	30	32	NE.	4	28	NE.	23	25	N.	23	36	N.	6	36	NW.	22	91

PRECIPITATION, NOVEMBER, 1905–OCTOBER, 1906.

Precipitation in the Lake region during the above-mentioned period was below the average, except in the Lake Superior basin, where heavy rains in June and August not only offset droughty conditions in April, May, and September, but gave a slight positive departure for the year. The snowfall in the Lake Superior basin in January and March, 1906, was much heavier than in the previous year, and the total for the year was the greatest since the winter of 1898–99. In the remaining basins, however, there was a general deficiency in the snowfall, amounting to 2 feet in the Ontario basin and from a foot to a foot and a half in the Michigan, Huron, and Erie basins.

In commenting upon the weather conditions in the lake region during the winter of 1905-6, the writer said, in May, 1906:

The general effect of an open winter on the water levels of the Great Lakes, other conditions being normal, is to produce comparatively high stages in the spring and early summer months, an early maximum stage, and a rather rapid decline to the winter minimum. The shortage in the winter's snowfall and the comparatively dry weather that has prevailed up to the present time (May 25) would seem to indicate that the stages during the summer and fall months will be lower than for the corresponding months of 1905.

That the forecast here made was fulfilled is shown by the reports of the U. S. Lake Survey on the levels of the several lakes during the summer of 1906. The reports for July and September of 1906 are given below:

Gauge records of the U. S. Lake Survey (above mean tide at New York).

Lakes.	Stages, 1906.		Lower than during same month last year.	
	July. ^a	September. ^b	July.	September.
	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>
Superior.....	602.95	602.98	0.02	0.34
Michigan.....	581.40	581.02	.14	.39
Huron.....	581.48	581.16	.09	.29
Erie.....	572.67	572.40	.39	.23
Ontario.....	246.76	246.02	.34	.89

^a Fall, Lake Huron to Lake Erie, 0.30 foot less than year ago.

^b Fall, Lake Huron to Lake Erie, 0.06 foot less than year ago.

TABLE II.—*Precipitation, in inches and tenths, in Lake Region, 1905-6.*

Basins.	1905.		1906.										Annual.
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	
Lake Superior.....	2.4	1.2	2.4	0.8	1.5	1.5	3.4	5.0	2.1	4.0	3.0	3.3	30.6
Departure from normal.....	-0.2	-0.5	+0.9	-0.5	0	-0.7	+0.5	+1.6	-1.1	+1.1	-0.8	+0.4	+0.7
Lake Michigan.....	2.1	1.3	2.8	1.4	2.1	1.7	2.6	3.7	2.6	3.2	2.8	2.9	29.2
Departure from normal.....	-0.4	-0.9	+0.7	-0.6	-0.2	-0.9	-0.8	0	-0.5	+0.4	-0.3	+0.3	-3.2
Lake Huron.....	2.7	1.9	3.1	1.8	2.3	1.6	2.4	4.0	2.5	2.5	2.5	4.2	31.5
Departure from normal.....	-0.7	-1.4	+0.4	-0.5	-0.1	-0.4	-0.8	+1.0	-0.2	-0.2	-1.0	+0.6	-3.3
Lake Erie.....	2.8	2.0	1.6	1.0	2.8	2.1	2.3	3.2	4.0	4.4	2.8	4.4	33.4
Departure from normal.....	-0.5	-0.9	-1.2	-1.9	+0.2	-0.4	-1.1	-0.3	+0.8	+1.4	-0.3	+1.2	-3.0
Lake Ontario.....	2.2	2.9	2.0	1.1	2.9	1.8	2.8	5.5	3.1	2.6	2.8	5.0	34.7
Departure from normal.....	-1.0	-0.3	-1.2	-1.6	0	-0.3	0	+2.6	+0.1	-0.2	-0.1	+2.2	+0.2

TABLE III.—*Average snowfall, in inches and tenths, in the snow years 1904-5 and 1905-6 in the several Lake basins.*

Basins.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Annual.
Lake Superior:									
1904-5.....	1.9	6.4	20.8	14.4	7.3	4.7	4.0	0.3	59.8
1905-6.....	3.8	14.4	12.7	24.7	8.3	13.9	0.9	0.3	79.0
Difference.....	+1.9	+8.0	-8.1	+10.3	+1.0	+9.2	-3.1	0	+19.4
Lake Michigan:									
1904-5.....	0.4	1.3	13.6	15.4	15.4	3.2	2.1	T.	51.4
1905-6.....	0.2	4.4	5.5	11.6	6.9	8.6	0.6	0.6	38.4
Difference.....	-0.2	+3.1	-8.1	-3.8	-8.5	+5.4	-1.5	+0.6	-13.0
Lake Huron:									
1904-5.....	0.5	5.4	17.8	24.2	18.4	5.4	2.7	0	74.4
1905-6.....	0.7	8.8	11.8	13.6	10.7	12.1	1.3	0.1	59.1
Difference.....	+0.2	+3.4	-6.0	-10.6	-7.7	+6.7	-1.4	+0.1	-15.3
Lake Erie:									
1904-5.....	T.	2.9	10.5	14.1	13.4	3.0	2.3	T.	46.2
1905-6.....	0.2	1.5	4.5	4.6	5.9	14.8	0.6	0.1	32.2
Difference.....	+0.2	-1.4	-6.0	-9.5	-7.5	+11.8	-1.7	+0.1	-14.0
Lake Ontario:									
1904-5.....	0.2	4.3	17.9	25.6	20.5	5.2	2.8	0.1	76.6
1905-6.....	0.1	6.3	12.3	9.0	7.5	15.0	1.9	T.	52.1
Difference.....	-0.1	+2.0	-5.6	-16.6	-13.0	+9.8	-0.9	-0.1	-24.5

OPENING AND CLOSING OF NAVIGATION, 1906.

By NORMAN B. CONGER, Inspector and Marine Agent.

The high easterly winds of April 8 and 9 broke up the ice and cleared the Straits of Mackinac for navigation. The ice in Whitefish Bay was broken up by high easterly winds on April 12 and 13, and the last ice ran out of St. Marys River on April 27. The first steamers to pass up were the *W. A. Rogers* and *Clyde*, at 5.40 p. m., April 10, and the first downbound vessel was the steamer *Wm. Livingstone*, at 8.30 p. m., April 12, bound for Buffalo. The first vessel to pass up through St. Marys Falls Ship Canal was the steamer *F. B. Squires*, on April 15, and the steamer *Saxona* passed down on the same date. The first passage down through the Canadian lock was the steamer *Leafield*, on April 14. The steamer *Newmount*, from Fort William, passed down on April 16. The first up-bound passage was the steamer *Midland King*, on April 16. The steamer *Tadousac* passed up on the same date.

Navigation was opened between Detroit and Cleveland on March 5 by the steamer *City of Detroit*. This was the earliest opening since 1890. From March 13 until April 3 the steamers had considerable trouble with the ice fields over western Lake Erie, and for a period of about seven days the trips were discontinued.

The first through passages at Detroit were the steamers *W. A. Rogers* and *Clyde*, on April 5, bound for Lake Michigan.

The last downbound passage at the Straits of Mackinac was the steamer *James Laughlin*, at 10.20 a. m., December 16, and navigation at the Straits closed with the up-bound passage of the steamer *Mary Boyce*, at 4.15 a. m. on December 20. The last up-bound passage through the St. Marys Falls Ship Canal was the steamer *North Wind*, at 2.16 p. m., December 15; the last down-bound passage was the steamer *Northern King*, at 8.47 a. m., December 16. The last up-bound passage through the Canadian lock was the steamer *Yale*, on December 19, and the last down-bound was the steamer *Neepewah*, on December 17. A local tug, the *Andrew J. Smith*, was locked down on December 22.

The steamer *Yale* passed Detroit, bound for Lake Superior, on December 16, and the steamer *Mary Boyce*, bound for Lake Michigan, on December 19. The steamer *William G. Mather* arrived at Detroit from Buffalo on December 22. The last down-bound passage was the steamer *Phoenix*, which arrived here at 4 p. m., December 21, and passed on down the following morning.

The *City of Detroit* arrived on December 11 and laid up for the season, the last boat on the Detroit and Cleveland run, and no ice was encountered.

VESSEL PASSAGES AT DETROIT, MICH., DURING THE SEASON OF NAVIGATION.

[By courtesy of HOMER WARREN, Postmaster, Detroit, Mich.]

The total number of vessels passing the port of Detroit during the season of navigation was 22,058. This is 40 less than for 1905.

WRECKS AND CASUALTIES FOR 1906.

The season of 1906 closed abruptly on account of the cold weather of the fore part of December, which caused the ice to form so solid in the St. Marys River that steamers were blockaded until tugs could break a passage.

During the season 229 vessels were damaged to a greater or less extent, of which number 53 were total losses, through weather causes,

The estimated amount of losses for the season was \$2,043,850, of which amount \$1,250,950 was in total losses and the remainder in partial losses. The loss due to fog was \$663,400, and the greatest amount in any month (June) was \$217,200. The greatest loss from stress of weather, amounting to \$471,750, occurred in December.

A comparison of the casualties of the several lakes shows that the greatest loss this season was \$691,000 on Superior; the next greatest, \$428,000, on Erie, followed by Huron, with \$412,000; Michigan, \$324,500; connecting rivers, \$153,150, and Ontario, \$34,900.

The following tables give the detailed data and comparison with former years.

Vessels which became total losses during season of 1906.

Date.	Chart number of vessel.	Name of vessel.	Value of hull and cargo.	Number of lives lost.	Date.	Chart number of vessel.	Name of vessel.	Value of hull and cargo.	Number of lives lost.
LAKE SUPERIOR.					LAKE HURON—continued.				
1906.					1906.				
June 27	4	Tug Alfred W.....	\$8,000	0	Oct. 30	106	Barge Checotah.....	\$15,000	0
Oct. 8	13	Barge Pasadena.....	47,500	2	Nov. 17	109	Steamer Winona (Canadian).....	6,000	0
8	15	Barge Samuel H. Foster.....	8,000	0	27	111	Steamer J. H. Jones (Can. pasgr.)	5,500	26
8	16	Barge Wayne.....	8,000	0			Total.....	249,000	29
21	19	Tug Herbert (Canadian).....	1,500	0			LAKE ERIE.		
Nov. 6	22	Steamer Strathmore (Canadian).....	50,000	0	May 8	118	Schooner M. I. Wilcox.....	12,000	0
17	26	Steamer Theano (Canadian).....	140,000	0	8	119	Schooner Armenia.....	53,000	0
21	27	Steamer Panama.....	54,000	0	9	121	Schooner Algeria.....	51,000	2
Dec. 4	31	Steamer Golspie (Canadian).....	40,000	0	28	125	Schooner Mabel Wilson.....	21,000	1
6	32	Steamer Monarch (Can. pasgr.).....	160,000	1	28	129	Barge Wm. Case.....	2,500	0
12	36	Barge Elgin.....	3,000	0	Aug. 27	134	Barge Agnes L. Potter.....	2,000	0
17	38	Tug Adventure.....	1,000	0	Sept. 16	137	Steamer H. B. Tuttle.....	10,000	0
		Total.....	521,000	3	16	138	Steam yacht Adieu.....	500	0
LAKE MICHIGAN.					29	141	Steamer City of Concord.....	5,500	3
May 26	42	Scow Sunrise.....	500	0	29	142	Barge Negaunee.....	10,500	0
26	43	Scow Baker.....	500	0	Oct. 6	145	Schooner Ada McDora.....	5,500	0
June 5	46	Steamer Bulgaria.....	45,000	0	6	147	Barge May Richards.....	6,500	0
Aug. 11	53	Steamer Joseph L. Hurd.....	8,250	0	27	154	Steamer Lackawanna.....	35,000	0
Nov. 17	64	Schooner Margaret Dall.....	2,000	0	Nov. 21	159	Steamer Charles B. Hill.....	27,000	0
27	67	Schooner La Rabida.....	5,000	0	22	161	Steamer Conemaugh.....	55,000	0
Dec. 13	70	Steamer John M. Nicol.....	95,000	0			Total.....	297,000	6
		Total.....	156,250	0			LAKE ONTARIO.		
LAKE HURON.					Aug. 24	167	Schooner Reuben Doud (Can.)...	5,500	0
May 2	72	Tug Clipper.....	1,500	3	24	168	Schooner Fleetwing (Canadian)...	1,000	0
June 30	87	Steamer New Orleans.....	60,000	0	Nov. 22	173	Steamer Resolute (Canadian)...	14,500	6
Aug. 19	90	Steamer Gov. Smith.....	125,000	0	29	175	Schooner Queen of the Lakes (Canadian).....	6,700	0
Sept. 1	92	Schooner Cavalier (Canadian).....	2,500	0			Total.....	27,700	6
Oct. 10	97	Barge J. B. Comstock.....	14,000	0			Aggregate of total losses...		
10	98	Barge Abram Smith.....	15,000	0				1,250,950	44
27	103	Schooner Vienna.....	1,500	0					
27	104	Schooner West Side.....	3,000	0					

Table showing the total and partial losses on the Great Lakes for the season of 1906, the estimated value of each, the number of lives lost, and the cause of the disaster.

Lakes.	Number of vessels.	Number of total losses.	Total losses.			Partial losses.			Total estimated value.	Number of lives lost.
			Estimated value.	Due to fog.	Due to gale.	Number of partial losses.	Estimated value.	Due to fog.		
Superior.....	38	12	\$521,000	1	11	26	\$170,000	5	21	\$691,000
Michigan.....	33	7	156,250	1	6	26	168,250	12	14	324,500
Huron.....	46	11	249,000	2	9	35	163,200	19	16	412,200
Erie.....	47	15	297,000	0	15	32	131,100	8	24	428,100
Ontario.....	12	4	27,700	0	4	8	7,200	2	6	34,900
Connecting rivers.....	53	0	0	0	0	53	153,150	39	14	153,150
Total.....	229	49	1,250,950	4	45	180	792,900	85	95	2,043,850

Table showing the total and partial losses, by months.

Months.	Partial losses.	Total losses.	Total.	Months.	Partial losses.	Total losses.	Total.
April.....	\$25,000	0	\$25,000	October.....	\$63,850	\$160,500	\$224,350
May.....	87,500	\$139,500	227,000	November.....	94,500	365,700	460,200
June.....	105,800	113,000	218,800	December.....	172,750	299,000	471,750
July.....	59,500	2,500	62,000	Total.....	792,900	1,250,950	2,043,850
August.....	54,500	141,750	196,250				
September.....	129,500	29,000	158,500				

Losses due to fog.

By months.				By lakes.			
Months.	Partial losses.	Total losses.	Total.	Lakes.	Partial losses.	Total losses.	Total.
April.....	\$25,000	0	\$25,000	Superior.....	\$39,000	\$8,000	\$47,000
May.....	75,500	0	75,500	Michigan.....	54,500	45,000	99,500
June.....	104,200	\$113,000	217,200	Huron.....	127,200	185,000	312,200
July.....	50,000	0	50,000	Erie.....	67,500	26,500	94,000
August.....	36,000	125,000	161,000	Ontario.....	200	0	200
September.....	53,500	0	53,500	Connecting rivers.....	110,500	0	110,500
October.....	24,700	0	24,700				
November.....	52,500	0	52,500				
December.....	4,000	0	4,000				
Total.....	425,400	238,000	663,400	Total.....	398,900	264,500	663,400

Record of lives lost on the Great Lakes during the season of navigation through stress of weather or other causes, 1906.

Months.	Superior.		Michigan.		Huron.		St. Clair and rivers.		Erie.		Ontario.		Total.	
	Weather.	Other causes.	Weather.	Other causes.	Weather.	Other causes.	Weather.	Other causes.	Weather.	Other causes.	Weather.	Other causes.	Weather.	Other causes.
April.....				2	1			2	1	2			2	4
May.....				3	3			9	7	10			10	21
June.....		3	1	4	2	3		6		9			3	25
July.....	3	10		13	3	4		9	1	18	1		8	54
August.....				2		3				7			0	12
September.....	2	2	3	3				9	7	21			12	35
October.....	2	1	2	1	1			1		1	2		5	6
November.....		2	6		26			3		1	6	2	38	8
December.....	2		2			1		1			1		2	5
Total.....	9	18	12	27	36	11		40	16	69	7	5	80	170
Aggregate.....	27		39		47		40		85		12		250	

Total and partial losses on all lakes from 1895 to 1906, inclusive, with general averages.

Years.	Superior.		Michigan.		Huron.		Erie.		Ontario.		Rivers.		Annual total.
	Partial.	Total.	Partial.	Total.	Partial.	Total.	Partial.	Total.	Partial.	Total.	Partial.	Total.	
1895.....	\$147,202	\$301,300	\$160,723	\$617,103	\$271,250	\$226,500	\$49,100	\$146,250	\$4,800	\$2,300	\$42,400	0	\$1,968,928
1896.....	31,300	24,500	60,253	114,492	35,525	300	21,225	59,625	4,800	0	11,500	0	363,520
1897.....	30,000	56,500	29,800	28,450	96,650	217,000	8,000	99,000	0	120,000	12,000	0	697,400
1898.....	143,500	487,980	257,689	498,834	67,900	29,800	64,600	63,500	6,100	6,000	170,700	0	1,796,603
1899.....	40,500	96,900	155,800	83,700	51,000	17,800	30,250	108,500	4,800	22,000	2,500	0	613,750
1900.....	26,000	48,000	50,750	16,800	69,500	12,625	39,250	248,450	2,300	22,500	15,800	\$3,200	555,175
1901.....	126,950	397,500	151,900	47,100	104,250	201,600	12,500	26,500	16,500	0	48,500	16,000	1,149,300
1902.....	139,000	396,000	163,000	9,500	128,200	100,000	96,000	272,300	17,800	39,000	4,500	0	1,365,300
1903.....	143,200	197,000	230,650	130,275	72,600	57,300	58,750	57,700	11,200	5,500	25,000	0	989,175
1904.....	44,000	64,500	151,500	29,100	42,250	82,500	36,000	6,000	5,500	7,000	7,500	45,000	521,750
1905.....	656,250	1,829,400	123,100	326,500	182,250	522,000	63,000	226,500	13,250	10,500	49,000	53,500	4,055,250
1906.....	170,000	521,000	168,250	156,250	163,200	249,000	131,100	297,000	7,200	27,700	153,150	0	2,043,850
Average.....	141,566	368,382	138,618	174,842	107,048	143,035	50,815	134,277	7,854	21,875	45,212	9,808	1,343,333

Casualties on Great Lakes and connecting rivers.

LAKE SUPERIOR.

Date.	No.	Name of vessel.	Damages.			Lives lost.	Place, cause of damage, and remarks.
			Vessel.	Cargo.	Total.		
1906.							
May 12	1	Steamer Pere Marquette No. 5...	\$1,000	0	\$1,000	0	Whitefish Point; stranded during dense fog.
19	2	Schooner J. J. Barlum.....	1,000	0	1,000	0	Whitefish Point; stranded during northwest gale.
24	3	Steamer Uranus.....	30,000	\$1,000	31,000	0	Eagle River reef; stranded during dense fog.
June 27	a 4	Tug Alfred W.....	8,000	0	8,000	0	Near Pie Island; stranded during dense fog; slid off into deep water; crew escaped in lifeboat.
July 27	5	Steamer Charles W. Weston....	5,000	0	5,000	0	Keweenaw Point, 3 miles from Copper Harbor; stranded during dense fog.
28	6	Steamer Major.....	500	0	500	0	Sand bar opposite Chequamegon light; stranded during dense fog.
Aug. 21	7	Steamer Frank H. Peavey.....	15,000	0	15,000	0	North shore, 12 miles west of Two Harbors; stranded; heavy weather.
27	8	Steamer Frontenac.....	500	0	500	0	Mid-lake; upper works damaged during gale.
Sept. 15	9	Steamer Tempest No. 1.....	1,500	0	1,500	0	Near Emerson, Whitefish Bay; stranded during fog and heavy weather.
16	10	Steamer Crescent City.....	1,000	0	1,000	0	Entrance to Chequamegon Bay; stranded during blinding rain and high wind.
16	11	Barge No. 133.....	1,000	0	1,000	0	Entrance to Chequamegon Bay; stranded during blinding rain and high wind.
21	12	Dredge No. 2.....	15,000	0	15,000	0	Off Duluth Harbor; accident to machinery caused bad list; foundered in heavy sea; crew rescued by tug.
Oct. 8	a 13	Barge Pasadena.....	40,000	7,500	47,500	2	Fourteen miles northeast Ship Canal; stranded during gale; ore laden.
8	14	Barge Manila.....	1,000	0	1,000	0	Mid-lake; damaged by heavy seas after steering gear broke.
8	a 15	Barge Samuel H. Foster.....	8,000	0	8,000	0	Misery Bay; stranded during gale; no cargo.
8	a 16	Barge Wayne.....	8,000	0	8,000	0	Do.
9	17	Steamer Neepawah (Canadian)...	0	4,000	4,000	0	Mid-lake; cargo of machinery damaged by shifting during gale.
10	18	Steamer Juniata (passenger)...	1,000	0	1,000	0	Mid-lake; upper works damaged by heavy sea.
21	a 19	Tug Herbert (Canadian).....	1,500	0	1,500	0	Reef near Point Brule; crew and passengers escaped.
27	20	Steamer H. D. Coffinberry.....	500	2,000	2,500	0	Off Keweenaw Point; sprung a leak and lost deck load of lumber.
Nov. 29	21	Steamer Livingstone.....	500	0	500	0	Mid-lake; upper works damaged by heavy seas.
6	a 22	Steamer Strathmore (Canadian)...	17,500	32,500	50,000	0	Michipicoten Island; stranded on rocks; wheat laden.
17	23	Steamer Philip Minch.....	1,000	0	1,000	0	Near Fort Williams; stranded during gale.
17	24	Steamer E. L. Wallace.....	1,000	0	1,000	0	Mid-lake; heavy seas swept over vessel damaging upper works.
17	25	Steamer Stratheona (Canadian)...	500	0	500	0	Near Fort Williams; stranded during gale.
17	a 26	Steamer Theano (Canadian)....	75,000	65,000	140,000	0	Four miles east of Thunder Cape; during gale; struck rocks and slid off into deep water; cargo, steel rails; crew escaped in small boats.
21	a 27	Steamer Panama.....	45,000	9,000	54,000	0	Fourteen miles west of Ontonagon; stranded during gale; ore laden.
26	28	Steamer Susquehanna.....	1,500	0	1,500	0	Entrance to Duluth Harbor; struck bottom while in trough of sea; swung around against pier.
28	29	Steamer Turret Crown (Canadian)...	4,000	0	4,000	0	Grand Marais; missed harbor entrance during heavy snowstorm.
Dec. 3	30	Steamer Northern Queen.....	5,000	7,500	12,500	0	Point Abbaye shoal, near Houghton; stranded during dense snowstorm and high wind; cargo of general merchandise.
4	a 31	Steamer Golspie (Canadian)...	20,000	20,000	40,000	0	Brule Bay; stranded in northeast gale and snowstorm; grain laden; crew reached shore.
6	a 32	Steamer Monarch (Canadian passenger)...	100,000	60,000	160,000	1	Isle Royale; stranded during northeast gale; broke in two, and one part sank in deep water; passengers and crew reached shore.
6	33	Steamer R. L. Ireland.....	40,000	6,000	46,000	1	Gull Island; stranded during northeast gale and snowstorm; coal laden; one of crew drowned while being rescued by tug Crosby.
6	34	Steamer John Harper.....	1,000	0	1,000	0	Portage Lake; damaged by ice.
7	35	Steamer Ionic.....	10,000	5,000	15,000	0	Whitefish Point; stranded during snowstorm; cargo of package freight.
12	a 36	Barge Elgin.....	500	2,500	3,000	0	Grand Marais; waterlogged; towed to harbor and beached where she was broken up by heavy seas.
13	37	Steamer Wahcondah (Canadian)...	3,000	3,000	6,000	0	Off Fort Williams; upper works and grain cargo damaged by heavy seas and water.
17	a 38	Tug Adventure.....	1,000	0	1,000	0	Near Ontonagon; heavy weather; was being towed by tug Tramp when hawser parted and she stranded; abandoned.

LAKE MICHIGAN.

1906.							
Apr. 26	39	Steamer Starrucca.....	\$25,000	0	\$25,000	0	South Point reef, near Milwaukee; stranded in dense fog.
May 15	40	Steamer Lewiston.....	1,000	\$1,000	2,000	0	Off Roger Park, Chicago; stranded in fog and smoke; jettisoned part of cargo of coal.
18	41	Barge C. E. Wyman.....	500	0	500	0	Rowley Bay, near Deaths Door; stranded during dense fog.
26	a 42	Scow Sunrise.....	500	0	500	0	Racine Point; stranded during northeast gale.
26	a 43	Scow Baker.....	500	0	500	0	Do.
26	44	Schooner Minnie.....	500	1,500	2,000	0	Mid-lake; waterlogged and lost deck load of lumber during northeast gale.
June 26	45	Steamer Iowa (passenger).....	1,000	0	1,000	0	Hill Point, near Muskegon; stranded during fog.
5	b 46	Steamer Bulgaria.....	40,000	5,000	45,000	0	Washington Island; stranded during dense fog; part of cargo of coal jettisoned.
5	47	Steamer Roman.....	1,000	0	1,000	0	Summer Island; stranded during dense fog.
8	48	Steamer John Duncan.....	15,000	4,000	19,000	0	Off Cathed Point; collision with steamer Lehigh during fog; she proceeded to Northport where she sank; cargo of coal.

a Total loss.

b Constructive total loss.

Casualties on Great Lakes and connecting rivers—Continued.

LAKE MICHIGAN—Continued.

Date.	No.	Name of vessel.	Damages.			Lives lost.	Place, cause of damage, and remarks.
			Vessel.	Cargo.	Total.		
1906.							
June 8	49	Steamer Lehigh.....	\$1,500	0	\$1,500	0	Off Cathed Point; collision with steamer John Duncan during fog.
16	50	Steamer Georgia (passenger)...	1,000	0	1,000	0	White Lake, near Muskegon; stranded during dense fog.
20	51	Steamer Gladstone.....	1,000	0	1,000	0	Pilot Island, Green Bay; stranded during dense fog.
July 30	52	Steamer Topeka.....	500	0	500	0	North Point, near Milwaukee; stranded during dense fog.
Aug. 11	a 53	Steamer Joseph L. Hurd.....	7,500	\$750	8,250	0	Off Waukegon; waterlogged in heavy sea; lost part of cargo; picked up and towed to Chicago after she had been abandoned.
21	54	Schooner Hattie Hutt.....	500	0	500	0	Off Grosse Point, near Chicago; damaged by storm.
Sept. 10	55	Steamer Falcon.....	500	500	1,000	0	Three miles north of Charlevoix; stranded during dense fog and smoke; jettisoned part of ore cargo.
14	56	Schooner Mary E. McLachlan..	2,500	0	2,500	0	Manitowoc; struck breakwater off fog-signal station while attempting to enter harbor during high wind.
29	57	Car Ferry No.2 (W. and M.R.R.)	25,000	15,000	40,000	3	Inside breakwater at Chicago; capsized and floated bottom up; dumped 30 cars into lake.
Oct. 2	58	Steamer Silver King.....	500	0	500	0	Fishermans Shoal, Green Bay; stranded during gale.
10	59	Steamer Frank Woods.....	500	0	500	0	St. Joseph; collided with pier while attempting to enter harbor during heavy sea and blinding snowstorm.
21	60	Steamer Sidney C. McLouth....	2,500	4,500	7,000	0	Gull Island; stranded during heavy weather; cargo floats.
21	61	Steamer Shenandoah.....	1,000	0	1,000	0	Mid-lake; lost rudder and sustained other damage during heavy weather.
24	62	Barge L. P. Mason.....	500	0	500	0	Two Rivers; collided with pier while attempting to enter harbor during storm.
Nov. 16	63	Steamer Orion.....	1,000	0	1,000	0	North Point, near Milwaukee; stranded during dense smoke and fog.
17	b 64	Schooner Margaret Dall.....	2,000	0	2,000	0	South Manitou Island; stranded during easterly gale.
21	65	Steamer Pere Marquette No.16.	1,000	0	1,000	0	Near Peshtigo; damaged during gale.
22	66	Steamer Clarence A. Black.....	500	0	500	0	Mid-lake; upper works damaged by heavy seas.
27	b 67	Schooner La Rabida.....	4,000	1,000	5,000	0	Near Nubinway; stranded during gale and snowstorm; crew reached shore.
Dec. 3	68	Ann Arbor Car Ferry No. 1....	4,000	0	4,000	0	Mid-lake; 20 loaded cars broke loose during gale.
11	69	Steamer Binghamton.....	20,000	20,000	40,000	0	Two miles north of Skelligalle Light; stranded during heavy weather.
13	b 70	Steamer John M. Nicol.....	35,000	60,000	95,000	0	Big Summer Island; stranded during gale.
16	71	Steamer L. C. Waldo.....	12,500	1,250	13,750	0	Garden Island; stranded during gale.

LAKE HURON.

1906.							
May 2	b 72	Tug Clipper.....	\$1,500	0	\$1,500	3	Near Bustards Island; sprung a leak and sank.
2	73	Steamer Frank W. Hart.....	35,000	0	35,000	0	Mission Point, Mackinac Island; stranded during dense fog.
12	74	Schooner Dayton.....	1,000	\$1,500	2,500	0	Georgian Bay; waterlogged during heavy weather and lost, and jettisoned deck load of lumber.
17	75	Steamer F. B. Squire.....	500	0	500	0	Five miles east of Mackinaw; stranded during dense fog.
June 17	76	Steamer Geo. J. Gould.....	500	0	500	0	Mid-lake; collided with steamer Wawatam during dense fog.
17	77	Steamer Wawatam.....	700	0	700	0	Mid-lake; collided with steamer Geo. J. Gould during dense fog.
17	78	Steamer Manchester.....	15,000	0	15,000	0	Off Point aux Barques; collided with steamer Steel King during dense fog.
17	79	Steamer Steel King.....	30,000	0	30,000	0	Off Point aux Barques; collided with steamer Manchester during dense fog.
17	80	Steamer F. H. Prince.....	500	0	500	0	Mid-lake; collided with schooner Oliver Mitchell during dense fog.
17	81	Schooner Oliver Mitchell.....	1,000	0	1,000	0	Mid-lake; collided with steamer F. H. Prince during dense fog.
17	82	Steamer Saturn.....	1,000	0	1,000	0	Mid-lake; collided with schooner Ontario during dense fog.
17	83	Schooner Ontario (Canadian) ..	1,000	0	1,000	0	Mid-lake; collided with steamer Saturn during dense fog.
19	84	Steamer Alaska.....	1,000	0	1,000	0	Mackinaw Point; stranded during dense fog.
20	85	Schooner Maj. N. H. Ferry.....	500	0	500	0	Mackinaw; stranded during dense fog.
30	86	Steamer William R. Linn.....	5,000	0	5,000	0	Between Thunder Bay Island and Middle Island; collided with steamer New Orleans during dense fog.
30	b 87	Steamer New Orleans.....	45,000	15,000	60,000	0	Between Thunder Bay Island and Middle Island; collided with steamer William R. Linn and sank; crew rescued by steamer Linn.
July 23	88	Schooner James G. Blaine.....	500	0	500	0	Near Algoma Mills; stranded during a squall.
Aug. 19	89	Steamer Uranus.....	30,000	0	30,000	0	Off Point aux Barques; collided with steamer Gov. Smith during smoky and foggy weather.
19	b 90	Steamer Gov. Smith.....	85,000	40,000	125,000	0	Off Point aux Barques; collided with steamer Uranus during smoky and foggy weather; crew rescued by steamer Uranus.
23	91	Steamer Charles A. Street.....	500	0	500	0	West of Cove Island; stranded during dense fog.
Sept. 1	b 92	Schooner Cavalier (Canadian) ..	1,500	1,000	2,500	0	Waterlogged and later stranded on Chantry Island during heavy weather.
11	93	Steamer Rosemount (Canadian) ..	10,000	0	10,000	0	Twelve miles from Detour; stranded on rocks during smoky weather caused by forest fires.
27	94	Steamer John Harper.....	2,500	0	2,500	0	Port Sanilac; stranded during smoky weather and barge F. A. Georger which was being towed ran into steamer.
Oct. 5	95	Steamer J. W. Westcott.....	500	0	500	0	Round Island, Straits of Mackinac; stranded during dense fog.
5	96	Steamer Winona (Canadian)....	2,500	0	2,500	0	Giants Tomb shoal off Christian Islands; stranded during fog.
10	b 97	Barge J. B. Comstock.....	6,500	7,500	14,000	0	Duck Island; was in tow of steamer Langell Boys; hawser parted during gale and barge stranded; crew taken off by steamer.
10	b 98	Barge Abram Smith.....	7,500	7,500	15,000	0	Do.

a Constructive total loss.

b Total loss.

Casualties on Great Lakes and connecting rivers—Continued.

LAKE HURON—Continued.

Date.	No.	Name of vessel.	Damages.			Lives lost.	Place, cause of damage, and remarks.
			Vessel.	Cargo.	Total.		
1906.							
Oct. 10	99	Steamer Panther.....	\$1,000	0	\$1,000	0	Lower end of lake; lost rudder and sustained other damages during storm.
15	100	Steamer Samuel Mather.....	1,500	0	1,500	0	Corsica shoals; stranded during dense fog.
16	101	Steamer Three Brothers.....	500	0	500	0	St. Martins reef; stranded during thick weather.
24	102	Schooner Emma L. Neilson.....	500	0	500	0	False Presque Isle; stranded during gale.
27	a103	Schooner Vienna.....	1,500	0	1,500	0	Off Bender Bay; foundered during gale; crew escaped in small boat; no cargo.
27	a104	Schooner West Side.....	1,500	\$1,500	3,000	0	Twenty-five miles off Thunder Bay light; foundered during gale; crew escaped in small boat.
27	105	Steamer Pathfinder.....	5,000	0	5,000	0	Off White Rock; struck obstruction, broke wheel, and stranded near Harbor Beach during gale.
30	a106	Barge Cheeotah.....	5,000	10,000	15,000	0	Off Port Sanilac; waterlogged, broke away from towing steamer Tempest No. 1, and foundered during gale; crew escaped in small boat.
30	107	Steamer John Otis.....	500	1,500	2,000	0	Mid-lake; sustained damages and lost deck load of cedar posts during gale.
Nov. 11	108	Steamer Viking.....	1,000	0	1,000	0	Avery Point near Alpena; stranded during heavy snow-storm.
17	b109	Steamer Winona (Canadian)...	1,000	5,000	6,000	0	Duck Island; stranded during southeast gale; abandoned, and later towed to Collingwood, Ontario.
21	110	Steamer Penobscot.....	1,000	0	1,000	0	Saginaw Bay; upper works damaged by gale.
27	a111	Steamer J. H. Jones (Canadian passenger).....	5,000	500	5,500	26	Off Cape Croker; foundered with all on board during gale.
Dec. 6	112	Steamer Italia.....	1,000	0	1,000	0	Maekinaw; stranded during heavy snowstorm.
6	113	Schooner Amazon.....	1,000	0	1,000	0	Maekinaw; stranded during heavy snowstorm; she was in tow of steamer Italia.
6	114	Schooner Wawanosh (Canadian).....	1,000	3,500	4,500	0	Near Oseoda; broke from towing steamer and stranded during storm; lost deck load of lumber.
8	115	Steamer Eleanor (Canadian)...	1,000	0	1,000	0	Shoal near Pancake Islands; stranded during gale and intense cold; crew escaped in small boat.
10	116	Steamer Caribou (Canadian)...	1,000	0	1,000	0	Near Killarney; became disabled during storm and was picked up by steamer Midland.
14	117	Steamer Phoenix.....	1,500	0	1,500	0	Cheboygan Point; stranded during easterly gale and snowstorm.

LAKE ERIE.

1906.							
May 8	b118	Schooner M. I. Wilcox.....	\$8,000	\$4,000	\$12,000	0	Off Colehester; foundered in 24 feet of water; cargo coal; crew escaped in yawl.
8	a119	Schooner Armenia.....	42,000	11,000	53,000	0	Pelee Passage; foundered; cargo iron ore; crew rescued by steamer Pabst.
9	120	Schooner Iron Queen.....	3,500	0	3,500	0	Off Cleveland; waterlogged and abandoned by crew during westerly gale; later towed into harbor and sank.
9	a121	Schooner Algeria.....	40,000	11,000	51,000	2	Off Cleveland; foundered at anchor; cargo iron ore; part of crew picked up by steamer L. C. Hanna.
27	122	Steamer Midland Queen (Canadian).....	1,000	0	1,000	0	Port Colborne; stranded during northeast storm.
28	123	Steamer Frank H. Peavey.....	1,000	0	1,000	0	Entrance to Ashtabula harbor; stranded during northeast gale.
28	124	Schooner F. A. Georger.....	500	0	500	0	On Cleveland; sprung a leak and sustained damage during northeast gale.
28	a125	Schooner Mabel Wilson.....	15,000	6,000	21,000	1	Off Cleveland; foundered; ore laden; crew rescued by tugs.
June 8	126	Schooner Three Brothers.....	500	0	500	0	Mid-lake, western end; all masts carried away by storm.
13	127	Schooner Hattie Wells.....	500	100	600	0	Mid-lake; bulwarks smashed and part of cargo of coal (deck load) washed away.
17	128	Steamer Angeline.....	1,500	0	1,500	0	Point Abino; stranded during dense fog.
July 23	a129	Barge Wm. Case.....	1,500	1,000	2,500	0	Off Colehester Light; foundered during squall; crew taken off by towing steamer Saginaw.
25	130	Steamer C. W. Elphicke.....	25,000	1,500	26,500	0	Cleveland; crashed into new section of east breakwater; coal laden.
Aug. 2	131	Steamer Henry B. Hawgood.....	2,500	0	2,500	0	Buffalo; struck north pier during dense fog.
27	132	Steamer H. B. Tuttle.....	500	0	500	0	Off Lorain; sprung a leak during storm; put into Lorain harbor and sank.
27	133	Barge Wm. Granby.....	1,000	0	1,000	0	Near Cleveland; stranded during gale after having been cut loose from towing steamer Rhoda Stewart.
27	a134	Barge Agnes L. Potter.....	2,000	0	2,000	0	Near Cleveland; stranded during gale after having been cut loose from towing steamer Rhoda Stewart and later burned.
27	135	Barge Nelson C. Holland.....	500	0	500	0	Mid-lake; sustained damage during squall; in tow of steamer Fred Mereur.
Sept. 6	136	Steamer Sahara.....	15,000	0	15,000	0	Conneaut; struck breakwater while attempting to enter harbor during dense smoke and fog.
16	b137	Steamer H. B. Tuttle.....	10,000	0	10,000	0	Off Cedar Point; sprung a leak during heavy weather and stranded near Marblehead Light; later was released, broke in two while being towed into Sandusky and sank in the harbor.
16	b138	Steam yacht Adieu.....	500	0	500	0	Between Stony Point and Point Merville; foundered during storm; crew escaped on life raft.
20	139	Steamer State of Ohio (passenger).....	30,000	0	30,000	0	Rattlesnake Island; stranded during fog.
29	140	Steamer Fayette Brown.....	2,500	0	2,500	0	Lorain; struck pier while attempting to enter harbor during gale.
29	a141	Steamer City of Concord.....	3,500	2,000	5,500	3	Fifteen miles off Huron; foundered; cargo of coal; part of crew escaped in yawl.

^a Total loss.^b Constructive total loss.

Casualties on Great Lakes and connecting rivers—Continued.

F

LAKE ERIE—Continued.

Date.	No.	Name of vessel.	Damages.			Lives lost.	Place, cause of damage, and remarks.
			Vessel.	Cargo.	Total.		
1906.							
Sept. 29	a142	Barge Negaunee.....	\$7,000	\$3,500	\$10,500	0	Cedar Point; stranded and went to pieces; crew escaped in yawl; she was in tow of steamer City of Concord.
29	143	Barge Donaldson.....	500	0	500	0	Mid-lake; sustained damage during gale.
29	144	Barge Montpelier.....	1,000	0	1,000	0	Do.
Oct. 6	a145	Schooner Ada Medora.....	3,500	2,000	5,500	0	Buffalo; struck north breakwater while attempting to enter harbor; crew escaped to breakwater.
6	146	Steamer Benton.....	1,000	0	1,000	0	Bass Island; stranded during gale.
6	a147	Barge May Richards.....	3,500	3,000	6,500	0	Bass Island; stranded during gale; abandoned; she was in tow of steamer Benton.
6	148	Barge Ahira Cobb.....	1,500	0	1,500	0	Bass Island; stranded during gale; she was in tow of steamer Benton.
10	149	Steamer Empire City.....	1,500	500	2,000	0	Huron; stranded while attempting to enter harbor during gale; cargo iron ore.
16	150	Steamer Mars.....	2,500	0	2,500	0	Windmill Point; stranded during dense fog.
18	151	Schooner A. C. Tuxbury.....	500	0	500	0	Mid-lake; damaged by storm; she was in tow of steamer Sawyer.
18	152	Steamer Vulcan.....	5,000	0	5,000	0	Long Point; stranded during dense fog.
24	153	Steamer Sultana.....	2,500	0	2,500	0	Bar outside Erie harbor; stranded during gale.
27	b154	Steamer Laekawanna.....	30,000	5,000	35,000	0	East extension of Cleveland breakwater; stranded during gale; cargo of merchandise.
27	155	Tug Pinola.....	500	0	500	0	Near Sandusky; foundered during gale; recovered.
Nov. 6	156	Steamer W. H. Gilbert.....	7,500	3,500	11,000	0	Avon Point; stranded during dense fog; leaking; jettisoned part of coal cargo.
20	157	Steamer Mohegan.....	4,000	0	4,000	0	Buffalo; struck breakwater while attempting to enter harbor during gale.
21	158	Steamer Chauncey Hurlbut.....	2,500	0	2,500	0	Near Leamington in Pigeon Bay; stranded during gale.
21	a159	Steamer Charles B. Hill.....	18,000	9,000	27,000	0	Near North Madison; seams opened during storm and she was beached to prevent foundering in deep water; succeeding storms have completed the wrecking.
21	160	Steamer Pascal P. Pratt.....	1,500	0	1,500	0	Mid-lake; sustained damage during gale.
22	b161	Steamer Conemaugh.....	30,000	25,000	55,000	0	Point Pelee; stranded during gale; cargo of package freight.
Dec. 16	162	Steamer Sahara.....	5,000	0	5,000	0	Buffalo; collided with steamer Commodore, caused by ice.
16	163	Steamer Commodore.....	2,500	0	2,500	0	Buffalo; collided with steamer Sahara, caused by ice.
16	164	Tug Williams.....	500	0	500	0	Buffalo; forced under bridge and damaged by ice.

LAKE ONTARIO.

1906.							
May 27	165	Steamer John S. Parsons.....	\$500	0	\$500	0	Cape Vincent; torn from moorings and stranded during northeast storm.
June 8	166	Schooner Stuart H. Dunn (Canadian).....	500	0	500	0	Mid-lake; dismasted during squall; towed to Charlotte.
Aug. 24	a167	Schooner Reuben Dowd (Canadian).....	3,000	\$2,500	5,500	0	Near Toronto; stranded during northeast gale and is reported breaking up.
24	a168	Schooner Fleetwing (Canadian).....	1,000	0	1,000	0	Near Center Island; stranded during northeast gale; abandoned.
Oct. 6	169	Barge Walter A. Sherman....	1,500	1,000	2,500	0	Near Sodus Point; tow line parted and she stranded during gale; part of coal cargo jettisoned.
15	170	Schooner Bertie Calkins.....	100	0	100	0	Charlotte; struck light-house pier during dense fog.
19	171	Schooner Cornelia.....	100	0	100	0	Pigeon Island; stranded during dense fog.
Nov. 11	172	Barge Quebec (Canadian).....	500	0	500	0	Near Charlotte; tow line parted and she stranded during gale.
22	a173	Steamer Resolute (Canadian) ..	12,000	2,500	14,500	6	Off Toronto; foundered during gale; cargo of coal; part of crew reached shore in small boat.
23	174	Steamer J. D. Scott.....	500	0	500	0	Near Pultueyville; stranded during gale.
29	a175	Schooner Queen of the Lakes (Canadian).....	5,000	1,700	6,700	0	Off Sodus Point; foundered during gale; crew reached shore in small boat; cargo of coal.
Dec. 10	176	Steamer Fairmount (Canadian).....	2,500	0	2,500	0	Snake Island shoal near Kingston; stranded during gale.

CONNECTING RIVERS.

1906.							
May 25	177	Steamer Coralia.....	\$1,500	0	\$1,500	0	Round Island; collided with steamer Howard L. Shaw during dense fog.
25	178	Steamer Howard L. Shaw.....	1,500	0	1,500	0	Round Island; collided with steamer Coralia during dense fog.
25	179	Barge 123.....	1,500	0	1,500	0	Round Island; in tow of steamer Howard L. Shaw, collided with steamer Coralia during dense fog.
June 7	180	Steamer Faustin.....	500	0	500	0	American shore opposite Fawn Island; stranded during dense fog.
7	181	Barge Fulton.....	1,000	0	1,000	0	American shore opposite Fawn Island; in tow of steamer Faustin, stranded during dense fog.
15	182	Steamer Louisiana.....	500	0	500	0	Point Iroquois; stranded during dense fog.
16	183	Steamer Sultana.....	1,500	0	1,500	0	Iroquois Island; stranded during dense fog.
19	184	Barge Manda.....	10,000	0	10,000	0	Limekiln Crossing; stranded during dense fog and after being released stranded a second time.
19	185	Steamer America.....	1,500	0	1,500	0	Limekiln Crossing; stranded during dense fog.
19	186	Steamer Isabella J. Boyce.....	500	0	500	0	Near Bois Blanc Island; collided with steamer Frank E. Rockefeller during dense fog.
21	187	Steamer Henry B. Smith.....	1,000	0	1,000	0	Bar Point; stranded during foggy weather.
21	188	Steamer G. Watson French.....	1,000	0	1,000	0	Bar Point; stranded during foggy weather.
24	189	Steamer Amasa Stone.....	2,000	0	2,000	0	Cedar Point; stranded during dense fog.
25	190	Steamer W. R. Stafford.....	1,500	0	1,500	0	Lime Island; stranded during dense fog.
25	191	Barge Ed. McWilliams.....	2,000	0	2,000	0	Lime Island; stranded during dense fog; she was in tow of steamer W. R. Stafford.

a Total loss.

b Constructive total loss

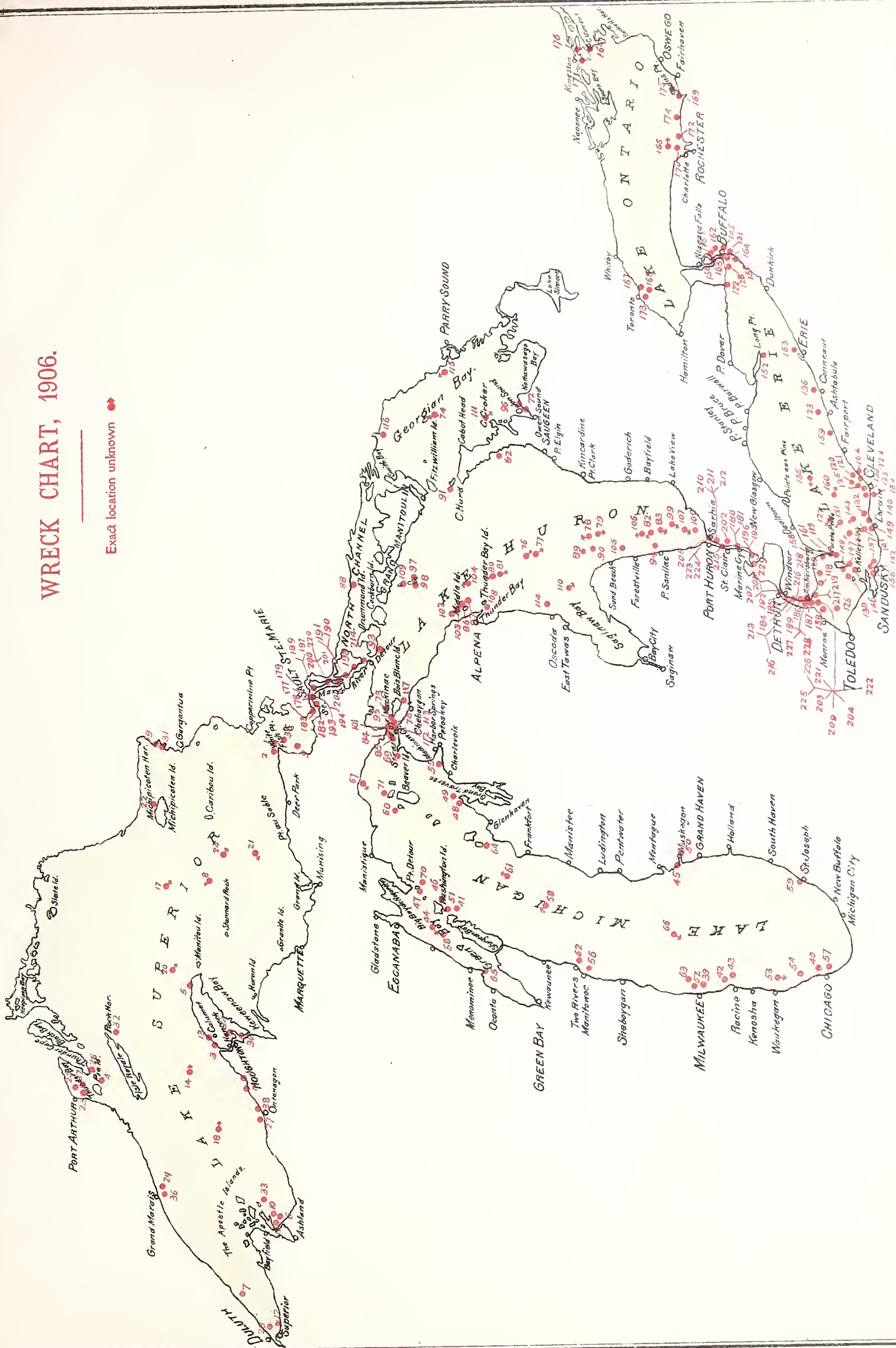
Casualties on Great Lakes and connecting rivers—Continued.

CONNECTING RIVERS—Continued.

Date.	No.	Name of vessel.	Damages.			Lives lost.	Place, cause of damage, and remarks.
			Vessel.	Cargo.	Total.		
1906.							
July 12	192	Schooner Crete.....	\$1,000	0	\$1,000	0	Fighting Island; stranded during dense fog.
18	193	Steamer Sonora.....	5,000	0	5,000	0	Round Island; stranded during dense fog.
21	194	Steamer Sonoma.....	5,000	0	5,000	0	Round Island; stranded during dense fog.
22	195	Steamer Henry S. Sill.....	4,000	0	4,000	0	Southeast bend, St. Clair River; collided with steamer Mariska during thunderstorm.
22	196	Steamer Mariska.....	5,000	0	5,000	0	Southeast bend St. Clair River; collided with steamer Henry S. Sill during thunderstorm.
28	197	Steamer Isaac L. Ellwood.....	1,500	0	1,500	0	Cedar Reef; stranded during dense fog.
29	198	Steamer L. C. Smith.....	5,000	0	5,000	0	Sailors Encampment; stranded during dense fog.
Aug. 5	199	Steamer Greyhound (passenger)	500	0	500	0	Sugar Island; stranded during thundersquall.
16	200	Steamer Clarence A. Blaik.....	1,500	0	1,500	0	Hay Lake; collided with steamer America during dense fog.
16	201	Steamer America.....	1,500	0	1,500	0	Hay Lake; collided with steamer Clarence A. Blaik during dense fog.
Sept. 20	202	Barge John Fritz.....	1,500	0	1,500	0	Stag Island; stranded during foggy weather.
20	203	Steamer Robert Fulton.....	1,500	0	1,500	0	Bar Point; stranded during foggy weather.
20	204	Barge James Nasmyth.....	1,500	0	1,500	0	Bar Point; stranded during foggy weather.
20	205	Steamer Hiawatha (passenger ferry).	1,500	0	1,500	0	Port Huron; struck obstruction during dense fog and was beached.
Oct. 2	206	Steamer Castalia.....	1,500	0	1,500	0	Foot of Dyke; stranded during dense fog.
6	207	Steamer Sultana.....	150	0	150	0	Smith's Coal dock; collided with steamer Hawgood during high wind.
6	208	Steamer H. W. Hawgood.....	1,000	0	1,000	0	Smith's Coal dock; collided with steamer Sultana during high wind.
14	209	Steamer Pendennis White.....	2,500	0	2,500	0	Bar Point; stranded during dense fog.
15	210	Steamer Jas. P. Walsh.....	1,000	0	1,000	0	Below Sarnia; stranded during dense fog.
20	211	Steamer John B. Cowle.....	1,500	0	1,500	0	Below Sarnia; stranded during dense fog.
20	212	Steamer Cherokee.....	500	0	500	0	Below Sarnia; stranded during fog, and the barge (Chipewa) which she was towing ran into her.
21	213	Steamer Auburn.....	5,000	0	5,000	0	Fighting Island; stranded during thick foggy weather.
24	214	Steamer Mueller.....	500	0	500	0	Cherry Island; stranded during high wind.
Nov. 2	215	Steamer Mars.....	1,500	0	1,500	0	Stag Island; stranded during dense fog.
3	216	Steamer City of Grand Rapids.....	1,000	0	1,000	0	Fighting Island; stranded during dense fog.
5	217	Steamer Robert Fulton.....	1,500	0	1,500	0	Bois Blanc Island; stranded during dense fog.
5	218	Steamer Clarence A. Blaik.....	1,500	0	1,500	0	Ballards Reef; stranded during dense fog.
5	219	Steamer Geo. W. Peavey.....	35,000	0	35,000	0	Bois Blanc Island; stranded during dense fog.
10	220	Steamer Winona.....	500	0	500	0	Dyke; stranded during snow squall.
21	221	Steamer David M. Whitney.....	2,500	0	2,500	0	Bar Point; stranded during gale.
21	222	Barge Antrim.....	1,500	0	1,500	0	Bar Point; stranded during gale; she was in tow of steamer David M. Whitney.
21	223	Steamer W. A. Rogers.....	7,500	0	7,500	0	Near Port Huron; collided with steamer W. H. Gilbert during high wind.
21	224	Steamer W. H. Gilbert.....	7,500	0	7,500	0	Near Port Huron; collided with steamer W. A. Rogers during high wind.
21	225	Steamer Maritana.....	1,500	0	1,500	0	Bar Point; stranded during gale.
21	226	Barge Maria Martin.....	500	0	500	0	Detroit; broke from anchorage and struck Belle Isle bridge.
Dec. 7	227	Steamer James Laughlin.....	10,000	0	10,000	0	Below Limekiln Crossing; stranded during gale.
13	228	Steamer Maunaloa.....	1,500	0	1,500	0	Near Amherstberg; stranded during dense fog.
13	229	Steamer F. B. Squire.....	2,500	0	2,500	0	Below St. Clair Flats; stranded during dense fog.

WRECK CHART, 1906.

Exact location unknown



W. B. No. 000.

Price 10 cents.

U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU.

METEOROLOGICAL CHART OF THE GREAT LAKES.

No. 1, 1907.

BY

ALFRED J. HENRY and NORMAN B. CONGER.

Prepared under direction of WILLIS L. MOORE, Chief U. S. Weather Bureau.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1907.

W. B. No. 000.

Price 10 cents.

U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU.

METEOROLOGICAL CHART OF THE GREAT LAKES.

No. 1, 1907.

BY
ALFRED J. HENRY and NORMAN B. CONGER.

Prepared under direction of WILLIS L. MOORE, Chief U. S. Weather Bureau.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1907.

AVERAGE ANNUAL PRECIPITATION IN THE LAKE REGION.

By ALFRED J. HENRY, Professor of Meteorology.

The average annual precipitation of the several Lake basins was computed by the writer in November, 1899. The mean values then determined were based on the available records both in the United States and Canada, supplemented by personal estimates of the annual precipitation for the areas over which no observations had been made. (Meteorological Chart of the Great Lakes, 1899.) This method, while not satisfactory, was the only one possible at the time.

Considering the vast extent of the watershed of the Great Lakes, the sparseness of the rainfall stations in some portions of its area, and the marked variations in precipitation which occur in various parts of the watershed, it is obvious that the absolute amount of water which is precipitated annually is difficult of determination. On the other hand, it is possible to determine a so-called working average by means of which the amount and the character of the variation from year to year can be ascertained. This information, properly correlated with the attendant meteorological conditions, will give a very fair indication of the probable height of the surfaces of the lakes above or below the respective planes of reference, provided, of course, the cross section of the various outlets remains constant. It seems desirable, therefore, especially in view of the fact that eight years' additional observations are available, to redetermine the mean values in the light of the new material thus afforded.

The observations used.—Measurements of the fall of rain and snow have been made in the Lake region for a period of thirty-six years, 1871–1906, at 21 stations, viz, Duluth, Minn.; Marquette, Alpena, Lansing, and Detroit, Mich.; Manitowoc, Milwaukee, and Madison, Wis.; Chicago and Riley, Ill.; Woodstock, Toronto, Gravenhurst, and Goderich, Ontario; Toledo and Cleveland, Ohio; Buffalo, Rochester, Oswego, Palermo, and Cooperstown, N. Y. These points may be considered as the standard stations, and the years 1871–1906 as the fundamental period. The total number of stations used in determining the mean values and constructing the chart, however, was 107, of which all but 7 had more than ten years' observations. The records of ten years and over were generally reduced to the fundamental period; in a few cases the corrected values were unsatisfactory, and the actual means were used. The reduction of short-period precipitation records to those of longer period was, on the whole, unsatisfactory by reason of the great variation in rainfall in limited areas and the very few standard stations that were available. Thus in the entire watershed of the Great Lakes, embracing an area of somewhat over 200,000 square miles, but 21 standard stations were available, or a single station to about 9,500 square miles. In general the reduction of the shorter to the longer period was accomplished by computing what may be called a regional departure for each term of years considered and applying the correction thus obtained to the short-term record. The so-called regional departure was computed for an area large enough to include several standard stations, in some cases as great as 30,000 square miles. Before applying the correction to individual short-period stations it was sometimes arbitrarily modified according to the geographic position of the station and the individual departure of the nearest standard station. The object in using several standard stations instead of a single one was to eliminate as far as possible the effect of local environment and other possible sources of error which might arise at an isolated station. Where the short-record station was clearly within the rainfall régime of the nearest standard station the latter was used as a reference point, provided all other requirements were satisfactorily met.

The annual distribution.—The distribution of precipitation in the Lake region is shown on Plate I. In general the total annual amount of rain and melted snow is about 31 inches.

For the greater part of the watershed the annual amount has been well determined, and the records cover a period long enough to warrant the belief that future observations will not materially alter the figures here given. In the northern portions of the basins of Superior and Huron there are considerable areas for which the amount of the annual precipitation is somewhat problematical. The best information on the subject leads to the conclusion that the annual fall over these unrepresented areas ranges from 20 to 24 inches.

The amount of precipitation on the Lakes themselves was assumed to be substantially the same as shown by observations over adjacent land areas. No serious error can arise from this assumption so far as the smaller lakes are concerned, but on Lakes Superior, Michigan, and Huron it is an open question whether the precipitation of midlake is the same as over land areas in the same latitude. The differences, if any exist, are probably small.

The Lake influence.—It is a rather common belief that the Great Lakes, by reason of the enormous possibilities of evaporation they possess, are an effective cause of precipitation, and that because of their presence the precipitation of the Lake country is greater than it would be were they absent.

The increase in precipitation due to the presence of the Great Lakes is believed to be small, probably not more than 2 or 3 inches annually. This conclusion is reached by considering the precipitation of the lake region in its relation to that of the remainder of the country east of the Mississippi. The heaviest precipitation east of the Mississippi occurs in the southern and southeastern States and the amount diminishes both in a northerly direction toward the interior of the continent and in a westerly direction toward the subarid region of the far West. The rate of decrease of precipitation, considering the region of 50 inches as a reference point, is quite sharp in a westerly direction, being as much as 30 inches in 450 miles, or an inch in 15 miles. In a northerly direction the decrease is much less; in 300 miles it is at the rate of 1 inch in 30 miles; for the next step northward, which includes the lake region, it is only an inch in 50 miles. In other words, the rate of diminution between the isohyetal of 50 inches and the isohyetal of 40 inches, if projected northward, would cause the isohyetal of 30 inches in the lake region to pass about 200 miles southward of its present position. This displacement would mean an average loss of 2 or 3 inches of precipitation over the greater portion of the lake region. Considering also the distribution of precipitation on both sides of the lake region it would appear that the foregoing estimate is a fair allowance for the increase of precipitation which might reasonably be attributed to the effect of the Lakes themselves.

An examination of the precipitation chart, Plate I, shows that the central and southern portions of the lake region receive between 30 and 35 inches of precipitation annually; in this area, however, are several islands of precipitation above 35 inches. Professor Harrington pointed out in 1894 (Bulletin C, U. S. Weather Bureau) that the areas of increased rainfall were generally southeast of the Great Lakes, and suggested as a probable cause the chilling of the air in its passage across the Lakes, causing it to deposit more moisture on the east than on the west side. In a recent paper ("Rainfall of the lake country for the last twenty-five years," Michigan Academy of Sciences, 1906), Prof. Mark S. W. Jefferson points out that the islands of increased rainfall are also areas of greater altitude than the surrounding country, and the increased rainfall is therefore largely due to the altitude of the hills and slopes that face the lake winds.

The principle involved in the above-mentioned phenomenon may be stated somewhat as follows: The precipitation of the winter season in the lake region is due almost wholly to the eastward movement of cyclonic storms. At this season of the year the surface water temperatures of the Great Lakes are generally higher than those of adjacent land areas in the same latitude. As a consequence, whenever the air is drawn across the lake from a higher to a lower latitude, its lower layers are warmed somewhat by contact with the surface water, and it reaches the leeward shore with a higher temperature and greater vapor content than would be the case had it passed wholly over a land surface. Moreover, the air is more nearly saturated in winter than at any other season of the year by reason of the low temperatures which then prevail. The result is that the atmospheric conditions on the lee shore are extremely favorable to pre-

precipitation, in the form of light snow, during the greater portion of the winter season. Vapor-laden air, at a temperature several degrees higher than obtains over land, is freely supplied, and as a result condensation continues so long as the inequalities in temperature exist.

The amount of vapor carried at the prevailing low temperatures is naturally small, but the duration of precipitation, as above stated, is much longer on the lee than on the windward shore; thus at Milwaukee the average number of days with 0.01 inch or more of precipitation in winter is 35, while at Grand Haven on the opposite shore it rises to 50, with a considerable number of additional days when less than 0.01 is recorded.

The phenomenon here described belongs to winter, late fall, or early spring. It is never observed in the warm season, since then the lake winds blow from a cooler to a warmer region.

Another interesting feature brought out by a study of the distribution of the precipitation about the Great Lakes is the fact that the summer precipitation on the western shore of Lake Michigan is greater than on the eastern shore. This is also true of Duluth, on Lake Superior, as compared with Marquette, farther east; also of Alpena, Mich., as compared with Saugeen, Ontario, on the east shore of Lake Huron. (See table of comparative monthly precipitation below.)

Comparative amounts of precipitation on the various sides of Lakes Superior, Huron, and Michigan.

[Computed for identical periods for each pair of stations and for periods ranging from 28 to 33 years.]

Months.	Lake Michigan.			Lake Superior.						Lake Huron.		
	Milwaukee (west side).	Grand Haven (east side).	Difference (east-west).	Port Arthur (north side).	Marquette (south side).	Difference (south-north).	Duluth (west end).	Marquette (south side).	Difference (south-west).	Alpena (west side).	Saugeen (east side).	Difference (east-west).
	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>
January.....	2.0	2.6	+0.6	0.4	2.3	+1.9	1.0	2.3	+1.3	2.2	3.9	+1.7
February.....	1.9	2.2	+0.3	0.7	2.0	+1.3	1.1	2.0	+0.9	1.9	2.9	+1.0
March.....	2.7	2.4	-0.3	1.0	2.3	+1.3	1.5	2.3	+0.8	2.0	2.8	+0.8
April.....	2.6	2.5	-0.1	2.0	2.3	+0.3	2.2	2.3	+0.1	2.1	1.8	-0.3
May.....	3.3	3.3	0	2.3	3.7	+1.4	3.4	3.7	+0.3	3.3	2.5	-0.8
June.....	3.7	3.4	-0.3	2.8	3.3	+0.5	4.2	3.3	-0.9	3.6	2.4	-1.2
July.....	3.1	2.8	-0.3	3.5	3.1	-0.4	3.6	3.1	-0.5	3.1	2.2	-0.9
August.....	2.8	2.6	-0.2	2.6	2.7	+0.1	3.4	2.7	-0.7	3.4	2.4	-1.0
September.....	3.0	3.6	+0.6	3.6	3.3	-0.3	3.1	3.3	+0.2	3.4	3.0	-0.4
October.....	2.2	3.0	+0.8	2.6	3.1	+0.5	2.8	3.1	+0.3	3.5	3.2	-0.3
November.....	1.9	2.8	+0.9	1.3	3.0	+1.7	1.4	3.0	+1.6	2.5	3.4	+0.9
December.....	1.9	2.5	+0.6	0.8	2.8	+2.0	1.3	2.8	+1.5	2.2	3.8	+1.6
Annual.....	31.1	33.7	+2.6	23.7	33.9	+10.2	29.0	33.9	+4.9	33.2	34.3	+1.1

It is suggested as a probable explanation of this difference that convectional overturning and the subsequent development of thunderstorms proceeds more freely on the unbroken land surfaces to the westward of these stations than over the lake surfaces which form the western outlook of the eastern shore. It is understood, of course, that the mean direction of thunderstorms in the lake region is from west to east.

In addition to the islands of relatively heavy precipitation discussed in the foregoing paragraphs there will also be found islands or limited areas of precipitation less than the general average. Four such are platted on Plate I—one in Charlevoix and Emmet counties, Mich., a second in the Saginaw Bay-Harbor Beach region, a third in the central lakes region of New York, and the last in the valley of the St. Lawrence as it emerges from Lake Ontario.

The relatively low precipitation of the two islands in New York can be referred at once to the light winter snowfall of those regions. In the case of the deficient areas shown in Michigan it would appear that light winter snowfall would only partly account for the deficiency. A complete explanation of this phenomenon is not at hand.

The average precipitation of the several basins.—The averages for the several lake basins finally adopted and the earlier averages are shown below.

Basins.	Number of stations.	Average for all stations.	Earlier averages.	Adopted averages.
		<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
Superior.....	17	28.0	28.0	28.0
Michigan.....	31	33.5	33.0	32.0
Huron.....	22	31.9	32.0	31.0
St. Clair.....			35.0	32.0
Erie.....	22	34.8	36.0	34.0
Ontario.....	20	34.1	33.0	33.0

The monthly averages by basins are as follows:

Monthly averages (in inches and tenths).

Basins.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
Superior.....	1.8	1.5	1.7	1.9	2.7	3.0	2.8	2.9	3.2	2.7	2.1	1.9	28.2
Michigan.....	2.0	1.8	2.3	2.3	3.4	3.6	3.3	3.0	3.4	2.8	2.4	2.0	32.3
Huron.....	2.7	2.1	2.2	1.8	2.8	2.8	2.5	2.6	3.0	3.1	2.9	2.9	31.4
Erie.....	2.7	2.6	2.6	2.4	3.2	3.3	3.4	2.8	2.9	2.8	3.0	2.8	34.5
Ontario.....	3.0	2.5	2.7	2.2	2.7	3.0	3.1	2.8	2.7	2.9	2.8	3.0	33.4

In determining the averages for the several basins the following method was pursued: The available material was platted on a large-scale map, from which the observing stations best representing each basin were selected, having due regard for geographic distribution as well as the length and reliability of the observations. For Lake Superior but seven suitable stations could be had, viz, Port Arthur, White River, and Missinabie, Ontario, Duluth, Minn., and Calumet, Marquette, and Sault Ste. Marie, Mich. The average values at these stations were weighted according to the proportion of the basin which each one represented, and the weighted means were then combined in a general mean for the entire basin.

Variation in annual precipitation.—The difference between the year of greatest rainfall and the year of least rainfall at a single station in the Lake Region may be as much as 30 inches. The difference between the average of the six wettest years and the average of the six driest years ranges from about 13 inches on the southern shore of Lake Superior to 20 inches on the western shore of Lake Michigan, as shown in the table below.

Stations.	Average.		Ratio of six wettest and six driest to general mean.	
	Six wettest.	Six driest.	Wettest.	Driest.
	<i>Inches.</i> (1)	<i>Inches.</i> (2)	<i>Per cent.</i> (3)	<i>Per cent.</i> (4)
Duluth.....	39.0	21.9	134	73
Marquette.....	39.6	26.3	125	83
Milwaukee.....	40.7	23.1	133	76
Grand Haven.....	45.7	25.5	137	77
Parry Sound.....	46.9	33.0	118	83
Toronto.....	41.6	26.9	126	80
Buffalo.....	49.2	30.6	134	83
Rochester.....	42.3	25.0	131	78

The facts presented in the above table indicate that a series of wet years at any one of the several stations will yield about 130 per cent of the normal, while on the other hand, a series of dry years will yield close to 80 per cent of the normal; if, however, one desires to know the average variation over a large area, say, in the basin of Lake Superior, the figures do not hold good on account of the very unequal distribution of precipitation. It is the exception rather than the rule that precipitation during a period so short as a month or year is distributed equally

over large areas. It often happens that one portion of the area has an excess of rainfall and another a deficiency, and that the two departures of opposite sign practically offset each other in the general mean.

During the last eight years the monthly precipitation has been determined for the several lake basins by taking the arithmetical mean of all of the observations made in each basin as the average for that basin. The disadvantage of this method lies in the fact that the observing stations are not always well distributed throughout the basin, and this is particularly true of Lakes Superior and Huron. The northern portion of the watershed of these lakes is not represented by any permanent observing station. As a result, the published values are doubtless too high so far as the absolute amounts are concerned, but since they are comparable with each other, the following conclusions may be drawn: First, as to the range from one year to the next, for by this we see at a glance the possibility of changes in the level of the lakes due to an increased or diminished supply.

For the Lake Superior basin the greatest range was 11 inches, viz, from 35 inches in 1902-3 to 24 inches in 1901-2.^a For Lake Michigan, 10 inches, viz, from 34 inches in 1904-5 to 24 inches in 1901-2. For Lake Huron, 4 inches, viz, from 34 inches in 1902-3 to 30 inches in 1900-1901. For Lake Erie, 8 inches, viz, from 39 inches in 1902-3 to 31 inches in 1899-1900. For Lake Ontario, 9 inches, viz, from 40 inches in 1901-2 to 31 inches in 1898-99.

Mean annual precipitation in the Lake Region, 1899-1906, for the rain year November to October, inclusive.

Basins.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	Mean.	Range.
	<i>Inches</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
Superior.....	29.2	30.1	27.2	23.9	35.1	30.1	31.4	30.6	29.7	11.2
Michigan.....	28.4	32.2	28.6	23.9	33.4	30.1	34.0	29.2	30.0	10.1
Huron.....	32.6	30.1	30.0	34.6	34.3	31.2	30.9	31.5	31.9	4.6
Erie.....	33.0	31.7	31.8	39.4	39.2	34.7	33.1	33.4	34.5	7.7
Ontario.....	31.1	34.1	38.8	40.5	39.2	39.9	34.7	34.7	36.6	9.4

In one case only was the year of least precipitation immediately followed by the year of greatest precipitation, and in no case was precipitation uniformly heavy or uniformly light over the entire watershed of the Great Lakes. Generally speaking, the larger the area the less is the probability of the precipitation being uniformly above or below the average for any given period.

It will be seen that the greatest precipitation in the eight years occurred on the Superior, Huron, and Erie watersheds during the rain year 1902-3, on Michigan in 1904-5, and on Ontario in 1901-2. The year of least precipitation on Lakes Superior and Michigan occurred in 1901-2, on Huron in 1900-1901, on Erie in 1899-1900, and on Ontario in the year preceding.

Secular variation.—The variations from year to year at times suggest a sort of periodic oscillation above and below the mean. Thus, in the early seventies there was a period of heavy rains, culminating in 1876; also in the early eighties. The latter, however, seems to have been confined mostly to lower Michigan and other points to the eastward. There was also a period of light rains that began in the early nineties, culminating in 1895, and for a second time in 1899 and 1900.

The subject of cyclic variation in precipitation at best is an elusive one, and few practical results can flow from its serious consideration. The figures given in the above table clearly show that for the eight years 1899-1906 the variation of precipitation in the several lake basins are not synchronous; that there may be a marked shortage in one part of the watershed and a correspondingly great excess in another part. (See the record for 1902.)

If the thirty-six-year period 1871-1906 be divided into three equal periods of twelve years each, as in the table below, it will be found that the average precipitation of the middle and last periods is less than that of the first period. Although the showing made by this computation

^a The rain year in this discussion extends from November to October, both inclusive.

is suggestive, it is not safe to draw definite conclusions therefrom until confirmed by at least a century's observations.

Average precipitation by twelve-year periods.

Stations.	Means.			Stations.	Means.		
	1871-1882.	1883-1894.	1895-1906.		1871-1882.	1883-1894.	1895-1906.
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>		<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
Duluth.....	34.8	28.1	27.0	St. Paul.....	30.1	24.1	30.8
Marquette.....	32.4	32.4	32.6	Oswego.....	36.2	34.1	38.0
Milwaukee.....	34.4	30.5	28.6	Rochester.....	37.2	32.7	32.8
Chicago.....	36.7	33.1	30.2	Buffalo.....	36.8	39.0	34.8
Riley.....	33.6	33.2	31.0	Palermo.....	34.0	34.2	37.2
Grand Haven.....	37.2	33.6	30.9	Cooperstown.....	35.6	40.6	44.1
Lansing.....	31.2	32.3	32.3	Erie.....	42.1	40.7	33.5
Alpena.....	35.9	33.6	28.8	Gravenhurst.....	35.9	34.6	36.9
Detroit.....	35.5	29.6	31.5	Goderich.....	30.7	30.5	26.6
Cleveland.....	38.2	35.2	31.9	Parry Sound.....	36.9	38.7	42.3
Toledo.....	33.0	29.2	29.6	Toronto.....	30.6	32.3	30.9
North Lewisburg.....	39.6	41.7	37.2	Woodstock.....	34.4	34.0	30.0
Madison.....	34.3	32.9	27.5				
Manitowoc.....	31.2	31.3	28.1	Means.....	34.9	33.5	32.5

Tables of annual precipitation for all stations used in this discussion follow:

ANNUAL PRECIPITATION IN THE LAKE REGION 1826 TO 1865.

[Arranged by drainage basins.]

Year.	Superior.			Michigan-Huron.							Erie-St. Clair.							
	St. Paul, Minn.	Marquette, Mich.	Sault Ste. Marie-Fort Brady, Mich.	Milwaukee, Wis.	Beloit, Wis.	Embarrass, Wis.	Riley, Ill.	Lansing, Mich.	Manitowoc, Mich.	Alpena-Thunder Bay, Mich.	Detroit, Mich.	Ann Arbor-Ypsilanti, Mich.	Cleveland, Ohio.	North Lewisburg, Ohio.	Oberlin, Ohio.	Sandusky, Ohio.	Toledo, Ohio.	Buffalo, N. Y.
	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>
1826.....																		
1827.....																		
1828.....																		
1829.....																		
1830.....																		
1831.....																		27.3
1832.....																		
1833.....																		
1834.....																		
1835.....																		
1836.....											*40.3							
1837.....			36.9								27.2							
1838.....			34.4															
1839.....			24.0								24.3							
1840.....			33.1								29.6							
1841.....			*24.1	34.3							27.2							
1842.....			26.4								31.8							
1843.....			27.2								27.6							
1844.....			34.4	32.5							33.1							44.7
1845.....			29.8	20.5							21.5							34.8
1846.....			*28.5	25.3														
1847.....			31.6	22.4														
1848.....				33.5														
1849.....				31.1							33.4							
1850.....			35.7	26.4			53.0				25.4	22.9						
1851.....			45.3	30.4			56.9					35.6						
1852.....				29.3			42.0							58.8				
1853.....			21.7				45.4							45.2				
1854.....			29.2	*31.4							46.5	29.4		41.4	28.0			
1855.....			*22.8	36.0								49.0		52.5	48.1			
1856.....			*25.0	29.0	27.9		31.4						26.1	30.9	*24.6			
1857.....				30.9	*33.3		38.0						39.7	39.8				
1858.....		38.4		44.9	*47.1		50.3						44.2	41.0				41.9
1859.....	*29.9	40.0		28.9	*32.7		29.8			35.1	28.9	35.4	38.8	36.6		33.6		35.7
1860.....	*34.6	25.8		22.0			29.8			27.9	28.3		35.7	35.7		30.9		27.7
1861.....	*31.1	39.0		31.9	37.6		36.6			36.1	38.4	40.1	32.1	36.3		29.2	40.9	36.0
1862.....	34.2	30.2		38.7	39.6		41.1			36.9	31.5	29.0	36.9	37.7		39.6	44.8	35.6
1863.....	15.7	*35.6		31.8	29.8		25.6			31.0	30.6	27.5	32.2	36.6		26.4	33.9	27.6
1864.....	14.9	22.3		27.8	30.8	28.9	23.9	28.4	26.8	31.9	25.9		31.9	32.2		34.2	37.2	38.4
1865.....	38.1	26.1		30.1	24.5	*40.6	37.2	29.8	31.6	*31.3	21.1		31.3	46.0		40.0	39.6	31.9

ANNUAL PRECIPITATION IN THE LAKE REGION 1826 TO 1865—Continued.

Year.	Ontario.													
	Auburn, N. Y.	Cooperstown, N. Y.	Gouverneur, N. Y.	Ithaca, N. Y.	Lowville, N. Y.	Madison Barracks, N. Y.	Middleburg, N. Y.	Oswego, N. Y.	Palermo, N. Y.	Penn Yan, N. Y.	Potsdam, N. Y.	Rochester, N. Y.	Toronto, Ontario.	Utica, N. Y.
	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>
1826.							24.0							36.7
1827.	33.8				32.9		30.0							47.8
1828.	34.9			24.4	35.6		38.4				35.7			36.6
1829.	30.5				28.1		29.8			32.4	27.7			36.2
1830.				35.6	36.7		38.5			30.1	34.5	34.9		46.2
1831.	37.9				39.8		29.8			29.9	30.4	34.6		37.8
1832.	30.9				29.1		28.6			30.7	22.1	31.4		49.9
1833.	34.0		33.8	26.6	35.1		30.7			25.9	39.3	30.3		37.8
1834.	24.7		26.7				27.4			22.4	25.2	29.9		34.5
1835.	34.3		46.2		39.1		34.1			26.5	29.7	32.7		28.6
1836.	31.3									27.8	18.5	28.0		33.2
1837.	29.0			28.2						24.6	28.6	31.0		*27.5
1838.	21.7		20.0	33.8						31.4	26.8	25.7		
1839.	33.4		19.6	22.2	28.4					31.3	23.0	30.1		35.4
1840.	37.4				40.0		32.4			29.5	32.5	29.4		45.8
1841.	28.2		22.8		28.9	32.4	31.5			24.0	20.8	32.3		41.9
1842.	40.8		18.9	39.9	34.5	37.3	28.0			31.5	28.5	33.2		56.7
1843.	50.1		15.7	35.1	27.2	33.8	32.9			29.2	34.1	30.2	50.2	40.5
1844.	39.7		25.5	26.2	26.5	29.2	30.9	34.6		20.1	31.7	26.2	*29.3	35.7
1845.	34.4		33.5	31.9	30.7	32.4	25.2			24.4	31.0	34.4	27.9	40.3
1846.	32.1			30.7	26.9		25.7			28.9	26.0	37.1	38.6	36.4
1847.	39.8			31.4	36.2					27.7		36.1	37.0	*31.9
1848.	38.8		25.7	28.9	29.0					22.6	26.4	32.0	26.8	
1849.	40.7							26.9		23.0		33.4	36.6	
1850.								34.6		31.7		38.5	35.5	40.4
1851.				31.1	41.2			31.9		26.8		25.0	30.8	50.0
1852.				*32.6	32.8			32.5		*25.5		35.2	40.9	42.8
1853.										29.5		32.5	29.9	
1854.		37.9	29.0							19.7		29.4	32.7	
1855.		48.1	25.7					25.9		30.0		33.9	41.5	
1856.		34.6								21.7		26.4	28.0	
1857.		52.0			47.3					44.4		44.0	40.6	
1858.		45.4			34.4					26.8		36.0	32.6	
1859.		41.4			*37.3			*53.5		29.1		28.5	39.8	
1860.		33.7			36.2			50.0	44.9	25.6		30.4	28.0	
1861.		40.7	50.7					*44.6	47.8	32.7		36.0	34.5	40.5
1862.		38.0	32.3					56.2	47.0	31.5		40.2	34.0	43.5
1863.		47.3	*30.8					46.8	48.2	40.3		31.2	32.8	42.8
1864.		29.9	36.6					43.3	49.4	32.0		40.8	36.9	
1865.		35.4	27.8					43.2	43.4	31.8		35.3	32.9	

* Interpolated.

ANNUAL PRECIPITATION 1866-1906 IN THE LAKE SUPERIOR BASIN.

[Stations arranged alphabetically.]

Year.	Calumet, Mich.	Duluth, Minn.	Grantsburg, Wis.	Hayward, Wis.	Heron Bay, Ontario.	Ironwood, Mich.	Lake Winnibegoshish, Minn.	Marquette, Mich.	Missanabie, Ontario.	Mount Iron, Minn.	Nepigon, Ontario.	Port Arthur, Ontario.	Sandy Lake Dam, Minn.	St. Paul, Minn.	Sault Ste. Marie, Mich.	Savanne, Ontario.	White River, Ontario.
	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>
1866.....								29.5						27.8			
1867.....								20.3						*34.7			
1868.....								26.2						30.5			
1869.....								34.8						32.2			
1870.....								33.0						32.2			
1871.....		31.2						27.8						30.6			
1872.....		30.1						30.2						29.7			
1873.....		38.7						26.4						34.7			
1874.....		36.4						25.3						35.5	27.9		
1875.....		26.9						30.2						30.7	29.7		
1876.....		32.3						31.4						23.7	32.4		
1877.....		34.3						27.5						28.8	27.1		
1878.....		28.1						36.2				24.5		22.8	25.2		
1879.....		45.3						40.7				27.4		32.4	31.7		
1880.....		38.1						33.4				29.6		29.8	30.6		
1881.....		37.6						42.9				26.6		39.2	24.9		
1882.....		38.0						37.1				21.4		23.1	31.0		
1883.....		23.2						30.5				22.8		26.7	31.2		
1884.....		35.8						41.4				25.8		26.1	31.4		
1885.....		20.0						*28.6				18.8		25.3	27.5		
1886.....		33.4						29.3				23.3		22.9	31.3	18.1	
1887.....		28.6			20.4			25.6			27.0	25.5		25.8	23.2	22.8	
1888.....	*23.8	27.3						35.5			27.2	26.4		25.9	27.7	25.5	22.4
1889.....	31.2	32.0					21.3	30.3				24.5	21.3	17.0	31.6	26.1	33.2
1890.....	27.4	24.1	38.9				24.3	34.5	23.5			20.2	24.3	23.4	33.4	19.4	25.2
1891.....	24.7	29.5		24.4	26.6		*25.3	33.8			17.9	20.5	*25.3	21.7	24.2	30.6	17.1
1892.....	28.0	28.5					21.0	27.3			15.6	19.1	21.0	32.5	30.1	25.8	19.0
1893.....	26.0	23.3	23.0	*29.2	23.2		25.9	35.9			17.6	23.2	25.9	25.9	39.6	22.2	28.1
1894.....	33.4	31.7	27.9	19.6	31.4		23.5	35.6	21.1	34.7	16.3	22.5	23.5	25.8	38.5	28.2	23.9
1895.....	36.8	22.3	*26.5	29.8	28.4		25.9	33.0	29.2	36.1	15.1	22.5	25.9	24.3	30.5	28.5	26.1
1896.....	34.7	27.2	36.5	31.9	21.5		33.0	29.6	26.5	39.5		21.5	33.0	34.7	34.6	25.4	26.4
1897.....	28.6	30.9	34.4	34.9			27.4	30.0	23.0	*30.6		24.5	27.4	30.5	36.2	21.3	17.6
1898.....	35.0	19.7	29.1	29.2			25.0	27.5	18.1	*30.0		28.1	25.0	25.3	27.9	34.1	27.8
1899.....	39.3	30.6	31.5	*34.0	22.4		34.6	36.4	18.4	35.4		26.5	34.6	27.5	30.7	19.4	25.8
1900.....	40.6	23.1	35.7	42.0	23.1		36.0	32.3		31.5		27.1	36.0	34.2	30.9		27.8
1901.....	31.3	26.7	26.6	28.2	31.0		26.7	37.2		30.1		22.5	26.7	25.7	27.4		27.3
1902.....	35.0	26.1	27.2	28.5		21.9	24.1	26.8		31.1		21.8	24.1	31.7	26.0	26.6	28.5
1903.....	38.5	28.0	47.5	36.7		33.3	25.9	39.8		33.9		22.1	25.9	37.9	29.0	22.9	29.5
1904.....	32.5	24.4	34.8	32.2		*31.7	22.8	33.2		27.0		22.3	22.8	34.1	27.5	25.6	27.4
1905.....	35.4	35.8	41.7	32.1		27.6	36.6	28.2		42.8		26.1	36.6	30.8	25.8		25.8
1906.....	34.6	28.8	35.6	32.5		34.1	26.3	37.5		*28.9		25.1	26.3	33.2	23.7		23.2
Means.....	32.5	29.9	33.1	31.0	25.3	29.7	27.0	32.0	22.8	33.2	19.5	23.9	27.0	28.9	29.8	24.9	25.4

* Interpolated.

ANNUAL PRECIPITATION, 1866-1906, IN THE LAKE MICHIGAN BASIN.

[Stations arranged alphabetically.]

Year.	Angola, Ind.	Beloit, Wis.	Berrien Springs, Mich.	Charlevoix, Mich.	Chicago, Ill.	Embarrass, Wis.	Escanaba, Mich.	Florence, Wis.	Grand Haven, Mich.	Grand Rapids, Mich.	Green Bay, Wis.	Hart, Mich.	Hastings, Mich.	Hayward, Wis.	Ishpeming, Mich.	Kalamazoo, Mich.
	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>
1866.....		30.1				35.5										
1867.....					22.4	*30.2										
1868.....		35.2			36.5	38.8										
1869.....		30.4			31.6	*35.2										
1870.....		20.4			22.9	41.8										
1871.....		27.4			35.6	37.8				32.0						
1872.....		*25.3			29.1	28.5	32.6		32.5	33.5						
1873.....		33.9			36.4	34.9	27.1		28.1	41.7						
1874.....		28.5			28.6	31.0	31.1		*32.4	29.0						
1875.....		37.2			38.1	43.7	43.5		*28.2	32.9						
1876.....		40.8			36.5	48.7	42.4		46.3	34.6						40.2
1877.....		41.0			41.0	34.2	34.6		36.0	31.8						47.5
1878.....		41.2			41.9	37.3	32.7		33.7	35.7						46.1
1879.....		35.7			30.7	41.5	30.8		35.5	29.9						39.2
1880.....		36.7			37.3	49.9	30.2		46.6	45.4						41.2
1881.....		46.6			44.2	57.4	48.5		47.9	43.2						40.3
1882.....		38.0			41.3	49.0	40.1		42.2	41.7			39.3			33.7
1883.....		35.1			45.9	42.2	30.0		44.8	48.6						36.3
1884.....		33.8			34.6	62.0	43.1		46.6	46.7						40.0
1885.....		42.2			44.4	42.6	31.4		35.8	38.0						40.5
1886.....		*38.4			26.8	45.4	32.4		35.3	35.0						32.2
1887.....		33.7			29.1	43.5	23.0		32.7	38.8	32.6					34.5
1888.....		34.6			30.9	43.8	25.9		26.0	32.7	35.5	36.2	*31.1			28.0
1889.....		32.9			32.9	33.7	26.8		24.0	30.3	32.6	28.8	23.3			28.5
1890.....		40.1			32.7	45.0	30.0		32.3	34.4	38.3	37.2	36.4			35.9
1891.....		37.7			30.7	26.5	41.3	24.8	26.3		26.0	32.2		24.4		34.4
1892.....		40.4			36.6	45.0	32.8	32.2	31.8		33.0	38.5				33.3
1893.....		38.6			27.5		26.3	32.0	35.0		33.0	33.3	40.5	*29.2		34.8
1894.....		30.9			27.5		27.0	27.6	32.6	26.2	35.9	*31.9		19.6		26.1
1895.....		31.9			32.4		34.3	27.3	25.6	31.1	21.0	26.7	28.1	29.8		31.6
1896.....		52.0			33.1		33.6	29.5	30.2	29.5	33.1	*29.3	34.0	31.9		*43.4
1897.....		35.0			30.9	25.8	28.5	26.2	32.3	28.2	34.1	*34.3	32.7	34.7		36.5
1898.....		46.0			37.7	33.8	30.1	27.5	36.0	34.6	29.1	30.6	34.6	29.2		28.9
1899.....		35.4			31.4	26.5	25.3	32.6	28.0	29.5	25.8	25.3	28.4	*34.0	*41.1	36.5
1900.....		42.5			28.6		26.9	37.8	32.3	35.3	32.8	28.2	37.5	42.0	37.0	35.3
1901.....		40.6			24.5		29.9	32.7	26.4	36.1	26.5	28.2	31.3	28.2	30.4	21.8
1902.....		40.6			37.6		22.2	26.1	34.8	39.9	27.6	32.0	38.3	28.5	29.3	38.2
1903.....		39.3			28.1		32.6	43.3	33.2	35.6	28.9	*20.7	34.3	36.7	44.6	*36.5
1904.....		39.8			26.1		31.7	*29.7	23.9	27.9	30.6		*31.6	32.2	38.0	*29.4
1905.....		39.8			22.2		31.4	32.4	37.8	44.4	31.9		39.1	32.1		*33.9
1906.....		41.1			30.9		31.7	41.4	29.8	28.9	37.9			32.5		29.8
Means.....	38.8	32.8	40.0	28.8	32.8	41.0	31.6	31.9	33.8	35.2	31.3	30.8	33.8	31.0	36.7	35.3

ANNUAL PRECIPITATION, 1866-1906, IN THE LAKE MICHIGAN BASIN—Continued.

Year.	Koepenick, Wis.	La Crosse, Wis.	Lansing, Mich.	Lathrop, Mich.	Litchfield and Hillsdale, Mich.	Mackinaw and Ignace, Mich.	Madison, Wis.	Manitowoc, Wis.	Medford, Wis.	Milwaukee, Wis.	Mottville, Mich.	Oconto, Wis.	Reed City, Mich.	Riley, Ill.	Traverse City, Mich.
	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>
1866.....			39.4		41.3			27.2		34.0				27.8	
1867.....			24.6		37.6			24.3		24.6				29.9	
1868.....			27.0		48.1		46.8	30.5		29.3				44.8	
1869.....			33.1		38.4		28.1	38.4		37.5				42.5	
1870.....			37.8		43.4			28.6		26.6				29.5	
1871.....			27.2		35.5		29.4	27.8		32.0				27.8	
1872.....			26.8		31.9		22.4	23.8		26.3				33.3	
1873.....		23.3	31.7		44.2		27.5	34.2		30.6				28.4	37.6
1874.....		31.9	22.9		26.5		29.0	28.1		30.8				24.3	38.1
1875.....		38.7	28.4		38.1		22.8	30.3		35.6				34.7	42.9
1876.....		39.4	30.5		43.9		36.3	31.9		50.4				39.6	
1877.....		36.6	37.4		43.9		27.7	28.2		46.1			35.0	34.5	
1878.....		31.4	31.2		40.4		38.9	34.0		38.3			39.2	32.4	
1879.....		34.9	26.8		40.7		35.2	27.2		24.9			34.9	32.6	
1880.....		34.3	43.9		43.0		46.7	30.7		30.0			40.8	33.3	
1881.....		44.7	34.7		47.3		52.9	37.5		39.1			47.9	47.2	
1882.....		27.9	32.9		39.6		42.9	40.1		28.4			34.4	35.4	45.3
1883.....		33.7	48.4		*43.3	*33.7	*39.9	38.1		29.5			41.4	35.9	43.4
1884.....		35.3	36.3		33.5		49.2	40.5		30.6	32.5		40.8	34.9	42.5
1885.....		30.7	35.0			28.5	40.6	31.8		32.6	*39.6		38.4	35.8	38.8
1886.....		22.5	27.9			23.4	28.8	33.0		31.5	24.2			31.2	42.8
1887.....		17.4	31.1			15.1	38.9	26.5		30.5	34.4			33.2	33.1
1888.....		34.8	26.6				22.9	30.7		23.5	27.5		32.2	26.4	37.8
1889.....		24.4	22.7	28.4	23.3		20.2	28.5		31.7	25.8		26.6	24.5	35.0
1890.....		34.8	34.5	34.1	32.9	37.6	37.0	32.9	37.8	30.1	36.0			36.4	
1891.....	23.9	27.0	29.0	*25.3	29.4	29.1	24.3	24.6	30.4	29.8	29.7	25.6		31.3	
1892.....	35.2	36.2	32.1	*31.4	36.1	30.1	37.1	32.8	37.3	35.0	34.0	29.2		43.2	
1893.....	29.7	24.6	39.5	*32.2		33.5	31.4	30.9	30.1	32.9	32.4	23.4		29.9	
1894.....	23.8	22.9	24.7	*28.9		32.1	23.8	25.5	27.0	27.8	29.6	29.8		35.5	
1895.....	24.6	23.0	27.4	31.1		26.7	13.1	19.8	28.2	24.9	28.4	19.9		25.9	
1896.....	32.2	29.1	32.7	33.0		33.4	30.0	31.2	32.4	29.0	32.6	36.0		32.5	
1897.....	25.5	21.3	35.3	26.9		27.5	22.6	26.6	27.7	31.0	31.3	28.1	31.5	25.2	*31.7
1898.....	30.4	23.5	31.6	32.6	39.8	32.9	31.9	25.7	28.2	32.4	41.8	29.7	36.2	38.6	37.4
1899.....	31.3	35.3	25.0	30.9	35.2	33.4	27.0	21.3	32.0	22.8	32.3	25.8	34.5	23.9	25.5
1900.....	46.5	41.8	33.3	33.5	36.5	46.5	29.6	29.3	44.9	30.1	35.3	38.4	34.4	33.7	33.9
1901.....	33.0	34.9	35.2	45.9	32.8	35.9	20.2	25.9	29.0	18.7		28.1	26.2	19.7	31.8
1902.....	27.7	30.3	37.0		34.7	31.4	31.2	32.9	42.0	28.6		29.3	35.8	39.1	
1903.....	42.8	34.4	36.7		43.2	41.0	34.8	32.2	46.1	33.4		33.4		35.9	31.2
1904.....	43.0	25.4	27.1		37.6	36.4	31.4	30.3	41.1	29.9		34.7	27.7	28.0	26.0
1905.....	39.2	35.3	36.3			42.7	25.5	31.8	44.2	32.2		33.4	36.2	40.7	
1906.....	39.3	37.8	30.3			27.5	32.4	30.5	31.2	30.2		37.8	28.4	28.6	26.1
Means.....	33.0	31.2	31.9	31.9	38.1	32.7	31.8	30.1	34.7	30.8	32.2	30.2	35.1	34.4	35.9

ANNUAL PRECIPITATION, 1866-1906, IN THE LAKE HURON BASIN.

[Stations arranged alphabetically.]

Year.	Alpena, Mich.	Arbela, Mich.	Alma, Mich.	Barre, Ontario.	Biscotasing, Ontario.	Ball Mountain, Mich.	Cartier, Ontario.	Cheboygan, Mich.	Durham, Ontario.	Grayling, Mich.	Gravenhurst, Ontario.	Goderich, Ontario.	Hayes, Mich.	Harbor Beach, Mich.	Harrisville, Mich.	Owen Sound, Ontario.	Parry Sound, Ontario.	Point Clark, Ontario.	Port Huron, Mich.	Sault Ste. Marie, Mich.	Saugeen, Ontario.	Thornville, Mich.
	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>
1866.....				38.3																		
1867.....				31.0								22.2										
1868.....				30.1								31.9										
1869.....	*30.1			28.5								37.8										
1870.....	30.7			37.8								46.7										
1871.....	24.9			27.0							30.8	27.9										
1872.....	20.8			28.2							35.3	27.3						50.2				
1873.....	31.1			27.1							40.1	31.3						54.6				
1874.....	25.2			21.2							34.3	26.0						40.2		27.9	27.2	
1875.....	37.3			22.1							39.9	30.9					39.1	36.2	29.1	29.7	33.2	
1876.....	37.6			32.4							36.7	30.2					40.4	29.3	37.2	32.4	35.7	
1877.....	41.0			22.1							33.1	28.6					31.5	25.6	31.6	27.1	29.7	33.0
1878.....	38.5			38.2							46.9	39.4					37.5	32.3	39.9	25.2	35.3	35.2
1879.....	40.0			22.5							34.7	36.0				35.0	35.5	30.4	27.5	31.7	35.9	32.9
1880.....	43.6			32.8							39.1	33.3				44.5	42.8	26.6	38.7	30.6	37.9	39.0
1881.....	45.6			24.9							29.1	28.1			37.4	33.7	33.3	26.4	35.3	24.9	33.0	30.2
1882.....	45.1			25.6							31.0	30.0			39.3	33.2	34.8	22.7	41.0	31.0	28.2	35.3
1883.....	35.3			31.2					47.2		41.6	36.6				50.5	42.5		37.0	31.2	38.0	41.5
1884.....	35.5			25.6					42.5		35.1	28.7				39.9	34.1		29.2	31.4	34.1	36.7
1885.....	34.7			29.9					50.6		36.1	33.8			33.6	37.6	40.4	32.1	33.8	27.5	37.5	38.3
1886.....	40.1			28.4					40.9		35.2	36.4			37.4	36.3	39.1	37.1	29.8	31.3	36.5	30.9
1887.....	37.9	*33.9		23.9			26.2		41.8		31.4	36.9			38.9	29.5	34.0	31.3	24.8	23.2	33.8	31.6
1888.....	29.4	27.1		27.0			30.3		34.8		28.2	33.4		*23.1	29.7	30.6	32.6	29.9	24.3	27.7	31.5	25.6
1889.....	31.3	23.5	26.5	33.4			32.3		24.8		34.9	31.9		*22.6	32.7	35.6	33.4	33.4	22.2	31.6	35.1	24.6
1890.....	31.3	29.9	34.3	37.9	23.5	32.8	23.4		40.9	32.5	32.2	32.3	26.0	34.9	30.9	39.5	39.4	32.0	22.9	33.4	35.7	39.8
1891.....	31.6	*28.6	34.7	31.9		30.6	28.0	32.4	41.6	28.7	34.6	32.0		28.7		41.1	38.1	33.9	33.8	24.2	37.9	35.9
1892.....	32.1	33.3	36.2	35.9		34.3	30.6	*29.6	34.3	*28.0	38.3	26.1		34.3	39.1	42.4	43.9	34.9	33.9	30.1	41.5	31.6
1893.....	33.3	40.3	37.0	35.4		37.2	30.9	*25.1	46.5	*26.2	38.7	24.4	*30.0	33.8	38.5	43.1	48.0	34.4	34.8	39.6	34.7	32.6
1894.....	30.9	22.1	28.8	27.6	16.2	24.4		32.4	35.2	20.3	29.3	14.2	*19.7	*25.3	34.0	33.3	39.4	28.0	26.9	38.5	28.2	23.2
1895.....	21.6	29.1	24.4	36.8	21.6	26.8		27.7	35.1	23.6	31.7	17.7	22.8	*24.8	28.7	35.7	38.1	31.4	26.1	30.5	32.9	27.7
1896.....	30.1	28.7	31.5	35.7		31.5		31.8	32.9	24.4	39.2	17.3	*19.1	*24.1	32.6	31.9	33.3	27.0	28.4	34.6	28.4	31.4
1897.....	32.6	39.2	35.3	44.5		29.8		28.8	48.0	28.8	46.6	28.1	29.7	*28.6	37.9	50.1	46.3	32.6	32.1	36.2	40.4	29.2
1898.....	34.1	33.1	36.2	31.5		26.4		32.6	41.8	33.2	35.5	32.4	25.2	25.7	35.8	42.2	40.0	26.0	33.1	27.9	30.9	20.2
1899.....	29.9	35.7	26.8	35.1		24.9		29.8	38.5	27.3	35.9	24.0	22.5	24.0	32.3	47.7	44.0	31.6	25.8	30.7	32.0	29.1
1900.....	23.0	41.3	31.2	33.3		33.0		42.9	43.6	35.9	33.6	30.4	33.9	25.3	31.1	36.6	42.3	25.7	28.7	30.9	31.5	30.5
1901.....	25.2	*28.4	27.6	37.9		30.0		30.3		28.4	38.1	26.1	20.2	17.5	31.7	40.8	52.3	20.1	20.4	27.4	35.9	28.6
1902.....	29.0	46.8	37.6			44.4		24.0		32.2	36.6	28.8	37.8	34.7	34.6	49.4	46.1	24.4	35.8	26.0	34.7	41.8
1903.....	31.5	48.2	38.3			37.9		22.7		*34.3	35.3	36.7	35.1	28.9	36.0	45.9	38.2	34.9	32.9	29.0	35.9	39.9
1904.....	24.7	39.4	28.9			27.1		*27.4		32.0	36.3	31.3	*29.5	18.6	31.7	31.3	39.3	20.8	26.0	27.5	29.0	28.4
1905.....	28.1	34.3	40.2			39.4		19.3		30.5	37.4	24.0	29.6	40.2	32.7	36.2	43.0	32.2	29.0	25.8	38.4	41.1
1906.....	35.2	30.1	36.0			38.8		20.6		32.0	36.2	22.4	29.8	23.3	38.5	35.2	44.6	†16.8	27.3	28.7	34.0	40.7
Means.....	32.7	34.0	32.6	30.9	20.4	32.3	28.8	28.6	40.1	29.3	35.8	29.8	27.3	27.3	34.6	38.9	39.6	31.1	30.6	29.8	34.1	32.9

† Doubtful.

ANNUAL PRECIPITATION, 1866-1906, IN THE LAKE ERIE AND LAKE ST. CLAIR BASINS.

[Stations arranged alphabetically.]

Years.	Adrian, Mich.	Ann Arbor, Mich.	Ball Mountain, Mich.	Buffalo, N. Y.	Chatham, Ontario.	Cleveland, Ohio.	Conestoga, Ontario.	Defiance, Ohio.	Detroit, Mich.	Erie, Pa.	Findlay, Ohio.	Garrettsville, Ohio.	Hudson, Ohio.	North Lewisburg, Ohio.	Oberlin, Ohio.	Port Huron, Mich.	Port Dover, Ontario.	Port Stanley, Ontario.	Sandusky, Ohio.	Toledo, Ohio.	Wauseon, Ohio.	Woodstock, Ontario.
	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>
1866.....				34.9		48.9			31.7					49.6					42.8	40.7		
1867.....				31.4		31.5			26.9					31.8					28.9	31.4		
1868.....				38.7		35.8								46.3					42.2			
1869.....				43.5		37.9								42.7					42.4			
1870.....				43.1		47.3			31.7					32.3	*32.6							41.6
1871.....		26.8		30.6		30.1			24.2					30.6	*21.0					31.4		26.7
1872.....				31.2		34.4			25.6				*29.3	28.6						27.6	31.1	28.2
1873.....				44.6		41.3			34.3				*46.9	37.2						35.5		39.7
1874.....		32.6		30.4		33.4			26.4	37.8			36.6	34.0			22.8	31.8	37.8	25.8		29.1
1875.....				31.4		36.9			35.7	41.2			*30.1	43.2		29.1	30.1	29.4		28.0	38.3	34.1
1876.....				39.3		41.2			40.4	44.6			36.4	42.0		37.2	37.9	38.1		34.5	49.6	39.0
1877.....				34.5		33.1			35.2	38.9			32.9	37.3		31.6	29.9	34.2		35.2	38.6	26.7
1878.....	44.6			60.2		53.5			43.4	55.2			45.1	44.0		39.9	41.5	42.2	42.9	32.7	37.2	46.9
1879.....	36.9			30.5		41.5			37.2	36.2			*32.5	48.4		27.5	27.6	34.4	37.7	30.3	36.7	36.5
1880.....	43.1			39.3		37.4			47.7	40.9			*31.2	46.4		38.7	33.4	38.8	39.4	35.7	41.0	35.2
1881.....	64.0	39.9		35.9		35.0	31.0		45.4	37.6			*39.6	44.0		35.3	31.5	32.5	46.3	45.9	48.1	36.7
1882.....	46.3	36.2		33.8		40.0	29.5		30.3	46.4				45.8		41.0	31.1	32.6	42.5	33.0	33.6	33.8
1883.....	43.4	33.2		38.1		41.1	42.8		32.6	44.8				48.9	41.3	37.0	38.9	31.2		34.2	41.6	40.7
1884.....	34.5	29.2		37.1	28.3	33.3	46.7		28.2	45.5		*34.1		34.3	29.8	29.2	30.1	26.3	33.6	28.4	32.9	38.5
1885.....	41.3	35.1		52.4	33.9	39.9	36.0		28.2	52.1		43.0	38.0	38.8	34.0	33.8	30.2	35.4	34.2	33.2	36.0	38.0
1886.....	*34.0			44.8	29.2	27.3	38.9		26.7	37.5		30.6	30.9	40.6	*30.0	29.8	38.9	37.9	31.0	32.7	30.4	30.6
1887.....	38.3			31.6	32.6	35.4	29.2		29.0	45.1		38.8	35.0	35.0	25.6	24.8	25.6	29.6	29.8	32.0	34.1	29.7
1888.....	30.7			33.9	29.2	32.6	25.6		29.0	31.9		36.6	*39.6	47.6	29.1	24.3	32.6	30.8	26.4	25.9	28.7	26.5
1889.....	27.9	29.5		40.1	28.8	32.6	31.6		21.1	37.7		36.4	*36.3	30.8	28.5	22.2	26.6	35.8	34.9	21.8	35.3	32.2
1890.....	45.1	36.4	32.8	46.5	41.0	47.8	35.3		35.0	47.0	42.7	52.9	*49.7	45.2	45.9	22.9	37.8	43.4	38.6	33.6	39.3	40.8
1891.....	40.2	32.5	30.6	30.7		34.2			28.8	30.2	37.9	37.9	*37.6	44.2	34.9	33.8	28.8	35.3	30.7	27.1	37.1	38.3
1892.....	51.9	41.8	34.3	45.9		36.5			37.1	41.7	42.7	40.6		40.2	41.3	33.9	32.7	38.3	43.3	36.7	52.5	36.8
1893.....	39.0	38.3	37.2	38.6	31.3	33.9			34.2	40.0	37.3	46.1		49.1	38.5	34.8	36.8	40.9	29.0	23.8	42.7	27.1
1894.....	38.5	29.8	24.4	38.9	25.9	27.7	24.2	31.5	25.7	35.2	29.3	34.2		39.6	25.0	26.9	32.6	30.5	28.1	21.3	32.0	28.8
1895.....	27.8	25.9	26.8	32.0	24.7	26.8	28.4	23.2	25.0	35.5	28.5	33.9		29.0	26.9	26.1	29.3	30.9	26.8	25.3	29.1	29.7
1896.....	38.1	35.3	31.5	37.3	37.8	36.7	25.4	31.9	36.2	37.0	38.6	38.2	40.3	48.3	*27.0	28.4	34.6	36.7	31.8	33.1	46.6	25.8
1897.....	28.1	34.6	29.8	37.7	33.6	24.5	29.4	34.0	30.3	34.3	34.4	39.9	40.3	43.5	*29.3	32.1	39.9	34.5	28.4	30.3	38.8	30.3
1898.....	39.2	36.1	26.4	33.5	36.7	32.5		42.1	34.3	34.1	41.5	45.6	45.8	52.2	42.7	33.1	32.0	39.5	43.2	28.1	44.9	31.3
1899.....	35.7	29.3	24.9	29.4	26.0	24.5		33.3	26.4	28.4	30.8	34.7	38.7	34.0	32.4	25.8	27.6	30.6	30.8	27.1	36.8	25.2
1900.....	33.9	36.0	33.0	35.9	33.7	25.8		36.3	31.4	32.6	35.6	32.9	31.1	32.5	31.4	28.7	35.6	36.1	31.8	29.6	39.4	26.2
1901.....	24.9	30.8	30.0	35.5	25.4	38.7		31.7	28.8	31.7	27.9	39.9	36.3	29.6	28.1	20.4	28.5	32.5	25.5	26.3	35.3	32.8
1902.....	33.7	41.8	44.4	32.9		39.9		42.8	35.5	29.8	39.3	41.1	44.5	36.6	40.3	35.8	32.8	42.6	36.8	33.3	44.8	34.3
1903.....	*28.3	36.6	37.9	37.9	30.7	35.4		39.1	35.9	35.6	36.9	44.1	*44.2	28.7	39.2	32.9	38.8	41.1	33.6	35.1	38.9	25.9
1904.....	24.4	33.3	27.1	35.8	25.9	34.6		34.2	28.3	35.0	39.8	42.1	39.8	35.4	40.1	26.0	35.8	35.1	31.9	27.9	36.4	32.6
1905.....	31.3	36.5	39.4	35.8	25.7	31.9		35.9	32.0	33.6	41.6	40.1	41.7		29.9	29.0	31.1	28.5	28.9	28.6	34.3	28.2
1906.....	36.5	34.9	38.8	33.6	26.7	31.6		27.8	33.7	34.8	30.5	43.1	41.9		33.1	27.3	29.5	35.6	34.8	30.3	33.3	37.3
Means.....	37.3	34.0	32.3	36.7	30.4	35.6	32.4	34.1	31.4	38.5	36.2	39.4	37.8	40.0	33.0	30.6	32.5	34.9	34.1	32.3	38.0	33.0

ANNUAL PRECIPITATION, 1866-1906, IN THE LAKE ONTARIO BASIN.

[Stations arranged alphabetically.]

Year.	Alfred Center, N. Y.	Auburn, N. Y.	Cooperstown, N. Y.	Gouverneur, N. Y.	Georgetown, Ontario.	Hamilton, Ontario.	Haliburton, Ontario.	Ithaca, N. Y.	Kingston, Ontario.	Lowville, N. Y.	Madison Barracks, N. Y.	Oswego, N. Y.	Palermo, N. Y.	Penn Yan, N. Y.	Peterboro, Ontario.	Potsdam, N. Y.	Port Hope, Ontario.	Rochester, N. Y.	Toronto, Ontario.	Utica, N. Y.
	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>
1866.....			32.3	41.5		30.2						35.2	51.8	26.8				36.1	39.4	
1867.....			36.4	*32.6								35.2	37.9	*28.4	28.8			31.7	30.1	
1868.....			37.4	28.8		32.2						42.5	38.7		30.2			39.2	34.3	
1869.....			45.9	38.2		41.1						47.1	35.9		31.0			41.3	39.6	
1870.....			33.0	30.9		48.8					22.7	34.1	34.8		35.2			39.6	46.2	
1871.....			36.4	26.8		30.5					27.0	29.2	31.8		29.5			36.3	32.6	
1872.....			36.9	27.8		26.7					30.2	27.6	31.4		25.9			36.3	25.3	
1873.....			42.2	37.9		42.6					29.9	33.3	35.5		27.9			49.9	31.7	
1874.....			36.5	32.8		27.4		28.9			26.9	34.9	43.5	*29.2	24.6			35.6	24.3	
1875.....			37.7			33.8		29.2	29.7		23.2	31.4	30.0	26.9	27.6			29.9	29.7	
1876.....			35.2			36.8		35.4	32.3		26.7	34.2	40.6	33.8	24.4			35.8	32.4	
1877.....			34.5			21.4		23.6	31.3			33.2	30.9	31.1	21.8			34.1	25.6	
1878.....			39.0			46.2		38.6	48.2		38.8	55.8	45.0	41.4	37.5			48.8	48.5	
1879.....			30.2			29.7		21.2	35.1		22.3	36.6	31.2	*25.2	27.4			35.2	29.4	
1880.....			34.2			29.3		29.0	32.5		23.9	43.2	31.8	23.9	31.1			41.8	35.3	39.2
1881.....			34.1			28.0		32.9	26.0		32.8	39.2	29.9	30.4	27.6			38.2	27.1	41.0
1882.....			30.8			32.2		30.1	31.8		25.4	36.1	27.0	22.5	23.8			24.7	24.8	38.8
1883.....			36.0		32.5	30.9		35.4	38.4		28.3	34.5	32.8	33.8	19.9		36.4	*30.5	34.2	36.3
1884.....		27.7	35.1		32.6	30.8	29.6	34.2	35.7		29.1	31.5	24.2	26.7	33.8		32.7	31.2	28.6	40.2
1885.....		39.2	38.4		36.9	31.6	30.5	35.1	42.0		*26.8	33.1	33.2	30.2	31.5		35.6	28.3	33.9	47.2
1886.....		48.1	32.9		35.2	28.0	30.0	32.9	41.7		29.5	35.5	31.5	31.7	32.5		33.8	36.8	35.1	43.6
1887.....		36.4	35.9		23.9	19.2	25.1	30.6	32.7		22.9	23.4	28.3	26.4	22.7		29.8	20.3	25.8	41.6
1888.....		44.4	38.4		24.2		30.6	31.0	32.7		*25.1	32.8	31.8	31.1			28.8	27.8	26.3	45.0
1889.....			38.6		32.8		32.4	41.6	36.0		*40.0	40.1	36.4			*49.2	30.6	35.7	31.0	48.2
1890.....	49.1		58.1		34.3		27.2	46.4	34.2		32.1	40.9	42.4			45.0	34.7	43.1	37.5	*63.8
1891.....	*32.8		41.1		33.0		27.7	38.0	30.0	42.3	29.1	31.4	31.9			*39.5		33.6	31.3	*39.2
1892.....	36.1		50.5		30.2		32.6	40.5	35.0	44.7	40.7	34.8	44.1		33.0	*44.3	34.8	35.0	29.5	*53.7
1893.....	44.3		44.9		43.4		37.7	37.6	36.6	46.3	39.1	34.8	36.6			41.7		35.5	38.6	
1894.....	43.7		37.9		34.6		26.3	40.1	29.5	35.4	33.2	36.4	37.3		32.5	*27.4		35.1	29.6	
1895.....	31.2		36.7		30.0		30.1	28.7	26.0	32.2	30.1	32.5	29.7		27.3	32.0		30.4	28.0	
1896.....	37.9		39.3		30.5		34.1	36.2	25.8	34.5	33.0	38.3	33.6		31.6	31.4		36.8	29.1	
1897.....	*36.4		46.5		35.7		43.4	33.7	28.3	35.9	24.0	36.6	39.2		36.0	34.7	44.0	30.1	32.4	
1898.....	*40.1	44.7	51.9		34.4	31.3	28.7	39.5	31.5	36.8	*24.3	40.4	33.0	31.7	33.4		31.3	37.5	30.9	
1899.....	25.3	34.5	37.9		31.8	25.5	38.1	27.5	27.5	35.8	21.7	34.6	28.3	25.7	34.6		33.8	26.8	29.0	
1900.....	35.6	38.1	41.5		31.0	33.9	37.4	32.8	30.3	38.6		37.2	38.7	30.5	35.7		29.3	38.1	29.6	
1901.....		42.4	45.8		35.8		36.8	35.2	35.4	45.4		45.1	41.3	35.3	32.7		33.2	37.2	32.3	
1902.....		39.0	45.3		33.3	36.8	38.3	35.7	30.0	46.0		37.9	*35.7	29.2	37.8		38.9	29.7	31.0	
1903.....		40.2	49.4		36.8		29.7	35.5	34.4	48.6		39.6	39.7	34.0	29.0		34.4	29.4	30.6	
1904.....		41.6	40.1		36.4		35.3	30.0	35.1	36.6		39.5	54.2		34.0	35.0	37.7	34.6	35.7	
1905.....		41.9	45.8		33.1			38.0	37.2	44.9		38.1	42.1		27.8	41.8	31.7	33.5	31.3	
1906.....		42.9	48.8		36.6			33.1	32.3	34.1		36.2	30.5		38.1	35.2	26.8	29.7	31.0	
Means....	37.5	36.7	39.9	30.3	33.2	32.2	32.5	33.0	33.2	36.3	29.5	37.4	37.1	29.0	30.2	32.2	33.6	33.7	32.9	41.6

THE WINTER OF 1906-7 IN THE LAKE REGION.

The winter of 1906-7 was rather uneventful. On the whole the temperature was slightly above the average until April. That month and the May following were cold.

The total precipitation (rain and melted snow) for the period November, 1906-March, 1907, both inclusive, was about normal, except in the Lake Ontario basin, where there was a deficiency during February and March. The snowfall was slightly less than during the preceding winter.

In general it would seem that the amount of water available from the winter's precipitation is about the same as last year, probably a trifle less.

Precipitation (rain and melted snow) in Lake Region, 1906-7.

Basin.	1906.		1907.			Season 1906-7.
	November.	December.	January.	February.	March.	
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
Lake Superior.....	3.3	1.7	1.7	0.9	1.7	9.3
Normal.....	2.1	1.9	1.8	1.5	1.7	9.0
Difference.....	+1.2	-0.2	-0.1	-0.6	0	+ 0.3
Lake Michigan.....	3.4	2.2	2.9	0.6	2.4	11.5
Normal.....	2.4	2.0	2.0	1.8	2.3	10.5
Difference.....	+1.0	+0.2	+0.9	-1.2	+0.1	+ 1.0
Lake Huron.....	3.0	2.3	3.2	1.2	2.4	12.1
Normal.....	2.9	2.9	2.7	2.1	2.2	12.8
Difference.....	+0.1	-0.6	+0.5	-0.9	+0.2	- 0.7
Lake Erie.....	2.5	3.6	4.3	0.7	3.5	14.6
Normal.....	3.0	2.8	2.7	2.6	2.6	13.7
Difference.....	-0.5	+0.8	+1.6	-1.9	+0.9	+ 0.9
Lake Ontario.....	2.4	2.9	2.9	1.3	1.7	11.2
Normal.....	2.8	3.0	3.0	2.5	2.7	14.0
Difference.....	-0.4	-0.1	-0.1	-1.2	-1.0	- 2.8

Total snowfall for 1905-6 and 1906-7 in the several Lake basins.

Basin.	November.	December.	January.	February.	March.	Season.
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
Lake Superior:						
1905-6.....	14.4	12.7	24.7	8.3	13.9	74.0
1906-7.....	12.7	17.5	18.1	8.4	10.5	67.2
Difference.....	- 1.7	+ 4.8	- 6.6	+ 0.1	- 3.4	- 6.8
Lake Michigan:						
1905-6.....	4.4	5.5	11.6	6.9	8.6	37.0
1906-7.....	2.4	6.0	12.7	5.1	3.5	29.7
Difference.....	- 2.0	+ 0.5	+ 1.1	- 1.8	- 5.1	- 6.3
Lake Huron:						
1905-6.....	8.8	11.8	13.6	10.7	12.1	57.0
1906-7.....	3.0	12.2	15.6	11.2	6.7	48.7
Difference.....	- 5.8	+ 0.4	+ 2.0	+ 0.5	- 5.4	- 8.3
Lake Erie:						
1905-6.....	1.5	4.5	4.6	5.9	14.8	31.3
1906-7.....	2.5	8.9	10.2	5.4	4.8	31.8
Difference.....	+ 1.0	+ 4.4	+ 5.6	- 0.5	- 10.0	+ 0.5
Lake Ontario:						
1905-6.....	6.3	12.3	9.0	7.5	15.0	50.1
1906-7.....	5.8	15.3	12.2	12.0	5.3	50.6
Difference.....	- 0.5	+ 3.0	+ 3.2	+ 4.5	- 9.7	+ 0.5

ICE ON THE GREAT LAKES DURING THE WINTER OF 1906-7.

By NORMAN B. CONGER, Inspector and Marine Agent.

Ice formed on the upper lakes in November and on the lower lakes in December. However, the ice that remained throughout the season did not form until about the middle of January. This ice was soon well covered with snow and this covering lasted until the warm weather in the latter half of March.

The ice in the harbors formed to a greater thickness than during the season of 1905-6; and the greatest average increase, 8.9 inches, was at Lake Huron ports.

The reports from all sources indicate that there was more field ice in the lakes than during the previous season up to about March 1. The time elapsed from the date when ice was first observed till it had disappeared averaged about fourteen days more on Lake Superior than the previous season, while on all other lakes the elapsed time averaged nearly five days less. The greatest difference, about fifteen days, was reported from Lake Huron ports.

On March 1 there were extensive ice fields in all the lakes. Ten days later the fields had practically disappeared from Lake Michigan except over the northern portions, and it had so materially decreased in all the lakes that in comparison with the previous season there was less ice in all the lakes. The decrease continued steadily until about the end of March. Ice in sufficient quantities to obstruct navigation was reported only on the north shore of Lake Superior, Whitefish Bay, St. Marys River, the Straits of Mackinac, and the extreme eastern end of Lake Erie.

Opening of navigation.—Steamers succeeded in breaking through the ice in the harbor at Port Arthur and Fort Williams on May 17, though a report as late as May 28 states that these harbors were not free from ice on that date.

The harbor at Duluth was ice covered one hundred and fifty days and averaged 5 inches thicker than usual. Local navigation at Duluth was opened by the arrival of the steamer *Bon Ami* from Two Harbors on March 30. This is ten days earlier than navigation opened in 1906; however, the harbor was effectually blocked by pack ice from April 3 to 16.

At Houghton navigation closed on December 10, 1906, and the ice remained solid from that time until about the middle of April, 1907. Navigation was forced open through the canal entry on April 29 and through Big Portage on May 7, but the ice did not entirely disappear until after the middle of May.

A number of unsuccessful attempts were made to reach the Stannard Rock light-house; but on account of the continued ice-bound conditions the light keeper and his assistants were unable to make a landing until about May 15.

Field ice practically covered Whitefish Bay during the first three months of 1907, but did not become solid at any time. This ice obstructed the passage of the first of the down-bound fleet, but retarded navigation but slightly by the time the first of the up-bound boats reached there.

The local ferry began operations at Sault Ste. Marie on April 1, but the first steamer, *Ball Brothers*, from Lake Superior did not arrive until 6.45 p. m. of the 23d.

The first passage through the American lock was, down bound, steamer *Ball Brothers* on April 23 and up bound, steamer *Wm. A. Paine* on the 24th. The first passage through the Canadian lock was, up bound, steamer *E. Y. Townsend* and, down bound, steamer *Wm. H. Mack* on April 25.

The ice in the St. Marys River was not materially heavier than it has averaged, but the cold weather of April caused it to remain solid, and on some dates it apparently increased slightly in thickness, until broken by the ice crusher *Algoma* and the tugs *Boynton* and *Schenck* on April 24. The steamers *Charles Weston* and *William A. Rogers* arrived at Detour on April 3, after which time they were joined by up-bound steamers, mostly with cargoes, until at the time of the opening there was a fleet of about 60 steamers waiting.

The ice fields in Lake Michigan were mostly confined to the northern portions of the lake and had practically all disappeared by March 12, except over the extreme northeastern portion. The only hindrance to navigation caused by ice fields over the southern half of Lake Michigan was at Grand Haven on January 28, when the Milwaukee steamer was delayed three hours breaking through the ice pack at the harbor entrance, and at Milwaukee from February 27 to March 1, when high easterly winds packed the harbor, and the field extended into the lake about 3 miles.

The ice at the Straits of Mackinac was not as heavy as usual and was free from heavy windrows. It was broken up to such an extent that the steamers *W. S. Pollock* and *Joshua W. Rhodes* forced their way with but little difficulty on April 1 and proceeded through the north passage to Lake Huron. The south passage was cleared by the wind a few days later.

The field ice in Lake Huron drifted to the southern end of the lake and formed a bridge across the mouth of the St. Clair River early in February. Portions of the ice broke off from time to time and drifted into the river, causing some obstruction to navigation. On March 11 southerly winds moved the ice field about 2 miles up the lake, after which it did not again drift into the river in sufficient quantities to materially impede navigation, and by March 26 the river was clear.

The ice on Lake St. Clair began breaking up on March 20, and the Detroit River ran bank full until the 24th, on which date the ice was practically all out of Lake St. Clair and the Detroit River. Field ice drifted into the Detroit River from Lake St. Clair from time to time during the winter, but did not retard to any extent the movement of the ferries.

Navigation opened between Detroit and Cleveland on March 28, by the clearing of the steamer *City of Detroit* for Cleveland. No ice was encountered on this trip.

Extensive ice fields were reported along the entire south shore of Lake Erie on March 1 and they remained intact until about the middle of March, when strong southerly winds cleared this shore from Erie westward. From Erie to Buffalo the ice pack remained solid. The steamers *Charles Weston* and *William A. Rogers* cleared from Lake Erie ports on April 1. At this time there was very little ice in Lake Erie except a large field, well broken, extending up the lake from Buffalo. Navigation was impeded by this field until April 21, when large areas of open water appeared in the north portion of the field, and by the 24th what was left of the field was confined to the bays on the south shore.

The steamer *Francis Robbins* cleared from Buffalo on April 6 and the steamers *W. G. Pollock* and *Joshua W. Rhodes* arrived from Lake Michigan ports on the 7th.

The Welland Canal opened on April 13.

Large fields of ice were reported in Lake Ontario about March 1, but during the second week in March southerly winds carried the fields into the lake and they did not return. After March 12 a few small fields were observed over the western portion of the lake, and the main field was confined to the extreme northeastern portion. These had practically disappeared by April 1, at which time all the harbors on the south shore were open.

The details for the several lakes follow:

Table showing the ice conditions on the Great Lakes during the winter of 1906-7.

LAKE SUPERIOR.

Stations.	Ice first formed.	Maximum thickness.		Ice disappeared.	Remarks.
		Inches.	Date.		
Two Harbors.....	Feb. 3, 1907	16	Mar. 6, 1907	Mar. 26, 1907	Moving ice fields appeared and disappeared with the change of the wind. But little ice formed outside the harbor owing to the strong currents and exposure.
Duluth.....	Nov. 23, 1906	36	Jan. 28, 1907	Apr. 21, 1907	The harbor was partially or entirely ice covered 150 days, the thickness being about 5 inches greater than usual. Ice formed in the lake Jan. 21, 1907, and more or less solid fields were in view from that date until Apr. 21, 1907. The maximum thickness of lake ice was 24 inches March 11 to 18, 1907, about 10 inches thicker than the average. The greatest area was from 10 to at times more than 40 miles of solid ice from Feb. 4, 1907, to Mar. 24, 1907. Local navigation was resumed by the arrival of the steamer Bon Ami from Two Harbors Mar. 30, 1907, 10 days earlier than in 1906, though the harbor was effectually closed by pack ice from Apr. 3 to 16, 1907.
Bayfield.....	Jan. 9, 1907	24	Feb. 24, 1907	Apr. 23, 1907	Some small fields still in the lake off this port.
Washburn.....	Dec. 8, 1906	32	Feb. 28, 1907	(*)	*Ice had not disappeared at the time of making this report, but was practically gone the last of April.
Ashland.....	Dec. 10, 1906	18	Mar. 1, 1907	Apr. 27, 1907	The ice was snow covered to such an extent that it did not make to the usual thickness.
Ship Canal.....	Nov. 29, 1906	24	Feb. 16, 1907	Apr. 22, 1907	Ice fields, 25 to 30 miles in extent, drifted in and out with the shifting winds.
Houghton.....	Nov. 30, 1906	20	Mar. 18, 1907	(*)	The ice remained solid all winter. Navigation closed on Dec. 10, 1906, and reopened on Apr. 29, 1907, through the Canal entry and on May 7, 1907, through Big Portage. *With the exception of the channel that was cut through by boats, Big Portage is still (May 9, 1907) well covered with solid ice. The city front became clear of ice on Apr. 23, but every east wind drives in considerable floating ice.
Eagle Harbor.....	Dec. 18, 1906	22	Mar. 1, 1907	Apr. 24, 1907	Open water in sight all winter, and the ice was heavily wind-rowed.
Presque Isle.....	Jan. 1, 1907	9	Feb. 14, 1907	Mar. 20, 1907	The ice broke up and moved out Feb. 15, but formed again to a thickness of 9 inches. It moved out again on Mar. 20.
Marquette.....	Jan. 21, 1907	12	Mar. 16, 1907	Mar. 23, 1907	Somewhat less than the average amount of ice formed in the lake and bay during the last season. It was twice broken up and drifted away by high offshore winds.
Munising.....	Dec. 25, 1906	14	Apr. 1, 1907	May 5, 1907	The ice fields were extensive from Jan. 10 to Apr. 20.
Grand Marais.....	Dec. 6, 1906	(?)	(?)	May 15, 1907	Field ice appeared on Jan. 16, 1907; on Jan. 21 the bay was full of ice. From this time on the ice moved with the wind and did not become stationary at any time during the winter.
Whitefish Point.....	Jan. 12, 1907	20	Mar. 11, 1907	*May 1, 1907	*On Mar. 29 very little ice was visible from this station, but the bay filled again and the first passage was not made till Apr. 23.
Sault Ste. Marie.....	Dec. 4, 1906	21	Feb. 25, 1907	(*)	River frozen from shore to shore Jan. 16; teams crossing on Jan. 22; ferry stopped running Jan. 22 and began again on Apr. 1. The first steamer from Lake Superior arrived 6.45 p. m. Apr. 23. *River still full of floating ice at time of closing this report (Apr. 29, 1907).

LAKE MICHIGAN.

Gladstone.....	Nov. 24, 1906	24	Jan. 26, 1907	(*)	Bay frozen over on Dec. 4, 1906. *Lower portions of bay clear of ice about Apr. 10, but upper portion still covered when this report is forwarded (Apr. 27, 1907).
Escanaba.....	Dec. 3, 1906	26	Mar. 9, 1907	Apr. 19, 1907	There was considerable floating ice observed on Dec. 8. Navigation closed on Dec. 17, 1906. The bay was frozen over from the light-house north on Dec. 18, but it was not until Jan. 14 that all open water had disappeared, and at this time the ice in the harbor averaged 11 inches. The ice broke up south of the light-house on Apr. 1 and mostly moved out into Green Bay on Apr. 9. Navigation was opened on Apr. 10.
Menominee.....	Nov. 30, 1906	24	Feb. 11, 1907	Apr. 14, 1907	It has been rather a mild winter here. The ice broke up on Mar. 29 and the Ann Arbor car ferry arrived on Mar. 31.
Green Bay.....	Dec. 7, 1906	14	Feb. 4, 1907	Mar. 11, 1907	Some ice was cut above the city measuring from 20 to 22 inches. The ice disappeared in the bay Mar. 29, 1907.
Sturgeon Bay.....	Nov. 30, 1906	24	Mar. 1, 1907	Apr. 3, 1907	The ice in the bay disappeared on Apr. 3, but the northerly winds of the 8th and 9th filled the bay with slush ice, and on account of the cold weather it remains at the time of forwarding this report (Apr. 12).
Kewaunee.....	Jan. ?, 1907	6	Feb. ?, 1907	Mar. 9, 1907	At times during January and February there was about 3 or 4 inches of ice on the lake. There was no harbor blockade here during the past winter.
Manitowoc.....	Dec. 1, 1906	16	Feb. 5, 1907	Mar. 1, 1907	This report covers the upper river. All ferryboats made their slips all winter without trouble.
Sheboygan.....	Dec. 21, 1906	3	Dec. 25, 1906	Mar. 8, 1907	During February only there was small fields of ice off this port. The river and harbor have been kept open all winter by tugs and car ferries. The bay inside the breakwater began freezing about Jan. 20. From this time till Mar. 10 there was more or less ice in the harbor, and it was frozen over for a short time. The ice fields disappeared Mar. 12. Navigation was impeded but once and that was caused by high easterly winds. The blockade lasted from Feb. 27 to Mar. 1.
Milwaukee.....	(?)	(?)	(?)	(?)	The ice fields were light during the past winter and did not become stationary off this port.
Racine.....	Dec. 16, 1906	(?)	(?)	Mar. 28, 1907	Ice fields did not become stationary off this port during the past winter.
Kenosha.....	(?)	(?)	(?)	Mar. 25, 1907	Less ice than usual.
Chicago.....	Dec. 23, 1906	5	Feb. 6, 1907	Mar. 13, 1907	There was less ice in the lake and it was lighter than for several seasons past.
Michigan City.....	Dec. 20, 1906	9	Jan. 20, 1907	Mar. 1, 1907	Harbor open all winter except a few weeks in February.
St. Joseph.....	Dec. 8, 1906	4	(?)	Feb. 27, 1907	There was very little snow or ice.
South Haven.....	Dec. 18, 1906	11	Mar. 11, 1907	(?)	

Table showing the ice conditions on the Great Lakes during the winter of 1906-7—Continued.

LAKE MICHIGAN.—Continued.

Stations.	Ice first formed.	Maximum thickness.		Ice disappeared.	Remarks.
		Inches.	Date.		
Saugatuck.....	Dec. 22, 1906	10	Feb. 15, 1907	Mar. 12, 1907	Ice fields off this port during the past winter were lighter than usual. Navigation opened Mar. 13, 1907. Somewhat more ice in lake than last season, moving to and from shore with shifting winds, and only remaining in sight for short periods.
Holland.....	Feb. 1, 1907	10	Feb. 15, 1907	Mar. 13, 1907	
Grand Haven.....	Jan. 21, 1907	1	Jan. 28, 1907	Mar. 22, 1907	
Muskegon.....	Jan. 15, 1907	14	(?)	Mar. 28, 1907	The first ice fields appeared in the lake Jan. 29; they were light and did not remain long. Clear water was visible off this port nearly all the past winter.
Ludington.....	Dec. 18, 1906	13	Mar. 1, 1907	Mar. 23, 1907	
Big Point Sable.....	Jan. 23, 1907	(?)	(?)	Mar. 19, 1907	But medium-sized ice banks formed on the shore line and very little ice was observed floating in Lake Michigan.
Manistee.....	Dec. 7, 1906	15	Mar. 2, 1907	Mar. 25, 1907	There was some floating ice visible during latter part of February, but less than former years, and at no time was the shore ice strong enough to prevent boats equipped for winter service from entering this harbor.
Glen Haven.....	Feb. 4, 1907	8	Mar. 7, 1907	Mar. 15, 1907	There has been very little ice here all the past winter; the channel was open at all times.
Frankfort.....	Dec. 15, 1906	16	(?)	Mar. 25, 1907	It was a very mild winter.
South Manitou Island.	Feb. 5, 1907	4	Mar. 1, 1907	Mar. 30, 1907	From Feb. 5 until Mar. 30 heavy fields of floating ice were visible from this station continuously.
North Manitou Island.	Feb. 5, 1907	(?)	(?)	Mar. 16, 1907	The ice at this station is formed by drift ice coming in from the north, and varies from a few inches to several feet.
Charlevoix.....	Feb. 10, 1907	14	Mar. 15, 1907	Apr. 18, 1907	Disappearance of ice Apr. 18 should be qualified, as some ice remains along the shore and in the harbor this date (Apr. 21), but steamers have been able to get through. Ice conditions past two weeks have been unprecedented for past 25 years.
Harbor Springs.....	Jan. 22, 1907	14	Feb. 20, 1907	Apr. 22, 1907	On Apr. 5 marine men considered navigation open, but winter weather followed and ice returned, blocking everything. There is still some floating ice in the bay at time of mailing this report (Apr. 25, 1907).
Beaver Island.....	Jan. 29, 1907	21	Mar. 15, 1907	Apr. 14, 1907	The ice was solid on the lake from the beginning of February until Mar. 26, when it broke up.
Mackinaw.....	Nov. 29, 1906	12	Feb. 20, 1907	Apr. 23, 1907	The ice was not as heavy as usual and free from heavy windrows. Only for a short time could a crossing be made with teams and then it was dangerous near shoal places.

LAKE HURON.

Mackinac Island.....	(?)	(?)	(?)	(?)	The thickness of ice in the Straits of Mackinac was less than for a number of years past and there were fewer windrows. The "North Passage" was open about Apr. 1. The steamers W. G. Pollock and Joshua W. Rhodes, downbound, passed this port on the evening of Apr. 4 going through the North Passage to Lake Huron.
Detour.....					
Cheboygan.....	Dec. 22, 1906	14	(?)	Apr. 1, 1907	The ice in the St. Marys River during the past winter was about the average thickness, but the cold weather and northerly winds of April caused it to remain solid until broken up by the ice crusher Algoma and the tugs Boynton and Schenck, which opened the passage to Sault Ste. Marie on Apr. 24. The ice in the channel off Lime Island was 18 to 20 inches thick as late as Apr. 24. The steamers Charles Weston and William A. Rogers arrived off this port on Apr. 3, and the waiting fleet had increased to about 60 steamers at the time of the opening. There were but few ice fields observed in Lake Huron off this port during the past winter.
Presque Isle Light....	Dec. 13, 1906	24	(?)	Apr. 13, 1907	
Middle Island.....	Nov. 16, 1906	8	Mar. 15, 1907	Mar. 25, 1907	Ice broke up and moved out early in January, but formed again. The first floating ice observed in the lake was about Jan. 15; it formed quite rapidly into large fields, and by Feb. 10 there was but little water visible.
Thunder Bay Island..	Dec. 7, 1906	21	(?)	Mar. 13, 1907	The first ice disappeared in a few days, but it formed again on Dec. 8. Large fields appeared early in January; it did not become heavy, but windrowed, and disappeared on Mar. 25. Thin ice formed again on Apr. 24 and 27.
Alpena.....	Dec. 9, 1906	20	(?)	Mar. 20, 1907	An ice bridge formed between the island and the mainland on Jan. 26, and it remained until Mar. 16; it was from 16 to 26 inches thick. The ice fields were lighter than usual.
Oscoda.....	Dec. 25, 1906	(?)	(?)	Mar. 20, 1907	On Dec. 16 there was sufficient ice to cause the local steamers to cease operations for the season. The ice was broken up and moved out during December and again in January, but it was solid and stationary from Jan. 26 to Mar. 19.
Ottawa Point.....	Dec. 4, 1906	22	(?)	Apr. 6, 1907	There was no solid ice off this port during the winter, but loose fields began coming in about Dec. 25, most of which disappeared early in January. From the middle of January to about the middle of March ice fields, part of the time quite heavy, moved with the wind, off this port.
Bay City.....	Dec. 10, 1906	15	(?)	Mar. 28, 1907	The ice fields moved with the wind off this point and at times the lake was clear of ice.
Pointe Aux Barques...	Dec. 1, 1906	14	Mar. 16, 1907	Mar. 25, 1907	The ice first formed in the bay on Dec. 10 and it continued solid till Mar. 22 when southerly winds moved it out. It was blown back in a few days, but entirely disappeared by Mar. 28.

Ice covered the lake from 1 to 3 miles out in December, and mostly disappeared early in January. Between Jan. 20 and Feb. 1 ice formed to a thickness of 10 inches and again extended out to the reefs. It increased in thickness during February, and reached the maximum about Mar. 16, when it extended 5 miles out. In comparison with the previous winter the field was about the same in thickness and extent.

Table showing the ice conditions on the Great Lakes during the winter of 1906-7—Continued.

LAKE HURON—Continued.

Stations.	Ice first formed.	Maximum thickness.		Ice disappeared.	Remarks.
		Inches.	Date.		
Harbor Beach.....	(?)	22	Mar. 20, 1907	Mar. 25, 1907	No solid ice outside the harbor; the fields drifted with the wind. The thickest ice usually occurs in February, but this year northerly winds kept it broken and moving. The ice in Black River was broken up twice, but remained solid from Jan. 9 till Mar. 21. The first floating ice in the St. Clair River was observed Dec. 7, and it was frozen over from Dec. 25 till Jan. 6, when the ice went out, leaving the river clear from Lake Huron to Lake St. Clair. The river was again frozen over from Feb. 14 until Mar. 22, when the ice went out. Navigation was impeded from Dec. 26 to Jan. 5, on Feb. 14 and 15, and again on Mar. 3, 4, and 5.
Lakeview Beach.....	Jan. 16, 1907	13	Feb. 2, 1907	Mar. 26, 1907	
Port Huron.....	Dec. 4, 1906	22	Mar. 1, 1907	Mar. 21, 1907	

LAKE ST. CLAIR AND DETROIT RIVER.

Detroit.....	Dec. 7, 1906	11	Mar. 4, 1907	Mar. 26, 1907	The river opposite the station was partially covered with floating ice most of the winter; the greatest amounts were observed from Mar. 20 to 24, following the breaking up of the ice in Lake St. Clair on the 20th. Navigation was but slightly impeded at any time.
--------------	--------------	----	--------------	---------------	--

LAKE ERIE.

Toledo.....	Dec. 23, 1906	11	Feb. 11, 1907	Mar. 15, 1907	Maumee Bay froze over, and the ice broke up about the same time as on the river. The ice began to break up about Mar. 5, and by the 20th it had entirely disappeared.
Put in Bay.....	Jan. 8, 1907	14	Feb. 7, 1907	Mar. 20, 1907	
Kelleys Island.....	Dec. 7, 1906	8	Feb. 7, 1907	Mar. 10, 1907	The ice remained firm during January and February, but early in March it broke up and drifted about in fields until it disappeared.
Marblehead.....	Dec. 23, 1906	8	(?)	Mar. 30, 1907	
Sandusky.....	Dec. 19, 1906	12	Feb. 12, 1907	Mar. 12, 1907	The bay was frozen over from Dec. 19 to Jan. 2, and was clear until the night of Jan. 20, when it again froze over, remaining solid until Mar. 2, when it showed signs of breaking. Strong southerly winds of Mar. 12 cleared the bay and lake of ice as far as could be seen from this station. Navigation closed Dec. 24 and opened on Mar. 11.
Huron.....	Dec. 19, 1906	12	Feb. 9, 1907	Mar. 20, 1907	The ice moved out of the river on Mar. 13. After forming, the ice remained practically stationary, except when it moved out on Feb. 19, until about Mar. 10, after which time it shifted with the wind.
Lorain.....	Dec. 25, 1906	19	Jan. 15, 1907	Mar. 19, 1907	
Cleveland.....	Dec. 25, 1906	12	Feb. 11, 1907	Mar. 16, 1907	The first ice formed in the lake on Jan. 23. It was broken up and moved off shore on the night of Feb. 1, but formed again Feb. 2 and continued, mostly in fields, until it was moved out by westerly winds on Mar. 25. The ice was considerably thicker than that of the previous season, and the closed season was longer than the average of the past ten seasons.
Fairport.....	Dec. 28, 1906	18	Feb. 7, 1907	Mar. 27, 1907	The ferry operating between this port and Port Stanley, Ontario, laid up on account of ice on Feb. 6 and resumed regular business Mar. 18. There was more and thicker ice this season than for some time past.
Ashtabula.....	Jan. 21, 1907	15	Feb. 15, 1907	Mar. 26, 1907	
Conneaut.....	Dec. 18, 1906	16	Mar. 1, 1907	Mar. 15, 1907	
Erie.....	Dec. 22, 1906	16	Feb. 15, 1907	Mar. 26, 1907	Navigation for last season continued unimpeded until Jan. 23. The lower portion of the harbor was open on Mar. 13, and by the 23d the harbor was nearly clear of ice. Ice covered the lake to beyond the horizon from about Jan. 23 till the high winds of Mar. 25-26 carried it out, though ice fields were observed in the distance on several occasions up to Apr. 5. Navigation was opened for Ashtabula on Apr. 1.
Dunkirk.....	Jan. 2, 1907	5	Feb. 15, 1907	Apr. 15, 1907	The ice started to move about Mar. 20 and shifted with the wind until it disappeared about Apr. 15.
Buffalo.....	Dec. 4, 1906	12	Mar. 11, 1907	Apr. 30, 1907	The first fields of thin ice appeared on the lake Dec. 7, but there was no ice of consequence till Jan. 23, when extensive fields formed and spread out over the lake beyond vision. This end of the lake was practically covered with a solid ice field from Jan. 31 till Mar. 25, when large areas were broken off and went down the river. Navigation was greatly impeded by ice fields till Apr. 21, when large areas of open water appeared in the north portion of the lake, and by Apr. 24 the ice field was confined to the south bay, from which it has rapidly disappeared since the 25th, and is now practically all gone (Apr. 30).

Table showing the ice conditions on the Great Lakes during the winter of 1906-7—Continued.

LAKE ONTARIO.

Stations.	Ice first formed.	Maximum thickness.		Ice disappeared.	Remarks.
		Inches.	Date.		
Fort Niagara.....	Jan. 23, 1907	12	Feb. 18, 1907	Apr. 26, 1907	There were large fields of ice in the lake most of the time during February, March, and the first half of April. The ice in the harbor was more or less broken up during the whole of the past winter, and there was less of it than during the preceding winter.
Charlotte.....	Dec. 8, 1906	12	Feb. 20, 1907	Mar. 30, 1907	
Sodus Point.....	Dec. 7, 1906	16	Feb. 15, 1907	Mar. 28, 1907	But few ice fields were visible in the lake during the past winter.
North Fair Haven.....	Dec. 7, 1906	18	Mar. 2, 1907	Mar. 30, 1907	Considerable ice appeared in the lake early in March, but it moved out with south winds and did not return.
Oswego.....	Dec. 7, 1906	17	Mar. 9, 1907	Mar. 21, 1907	There was no ice in the harbor from about Jan. 4 to 22. Although there was considerable cold weather during the winter, there was less than the average amount of field ice formed, while in the harbor it attained unusual thickness. Navigation opened on Apr. 5.
Sackett Harbor.....	Jan. 5, 1907	18	Mar. 10, 1907	Apr. 7, 1907	Ice was good, and there was more of it in the lake than during the previous winter.
Cape Vincent.....	Jan. 19, 1907	20	Mar. 15, 1907	Apr. 10, 1907	
Ogdensburg.....	Dec. 1, 1906	24	Feb. 1, 1907	Mar. 31, 1907	Ice formed on Dec. 1 and remained until Mar. 31. It was stronger than for many years, and the traffic over it to Canada was heavy.

THE DISPLAY OF STORM WARNINGS ON THE GREAT LAKES.

The storm-warning flags adopted by the Weather Bureau for announcing the approach of windstorms are as follows:

The storm warning (a red flag 8 feet square, with black center 3 feet square) indicates that the storm is expected to be of marked violence.

The red pennant (8 feet hoist and 15 feet fly) displayed with flags indicates easterly winds; that is, from northeast to south, inclusive, and that the storm center is approaching.

The white pennant (8 feet hoist and 15 feet fly) displayed with flags indicates westerly winds; that is, from north to southwest, inclusive, and that the storm center has passed.

When the red pennant is hoisted *above* the storm-warning flag, winds are expected from the northeast quadrant; when *below*, from the southeast quadrant.

When the white pennant is hoisted *above* the storm-warning flag, winds are expected from the northwest quadrant; when *below*, from the southwest quadrant.

Night storm warnings.—By night a red light will indicate easterly winds; a white light *above* a red light will indicate westerly winds.

The hurricane warning (two storm-warning flags, red with black centers, displayed one above the other) indicates the expected approach of tropical hurricanes, and also of those extremely severe and dangerous storms which occasionally move across the lakes and the northern Atlantic coast.

When orders to hoist this warning are received at any Weather Bureau station, every effort will be made by the officials and employees of the service to give the warnings the widest possible distribution, and all vessels will be notified that it is dangerous to leave port.

The regular Weather Bureau stations on or near the Great Lakes are:

Lake Superior.—Duluth, Minn.; Houghton and Marquette, Mich.

St. Marys River.—Sault Ste. Marie, Mich.

Lake Michigan.—Green Bay and Milwaukee, Wis.; Chicago, Ill.; Escanaba and Grand Haven, Mich.

Lake Huron.—Alpena and Port Huron, Mich.

Detroit River.—Detroit, Mich.

Lake Erie.—Toledo, Sandusky, and Cleveland, Ohio; Erie, Pa.; and Buffalo, N. Y.

Lake Ontario.—Rochester and Oswego, N. Y.

Storm and hurricane warnings are displayed at all regular Weather Bureau stations, and at a number of smaller ports, designated as storm-warning stations, in charge of displaymen, who hoist the warnings and post and distribute the bulletins, giving information of the storms on the Great Lakes.

At all lake stations, except Port Huron, Mich., a chart is issued daily, except Sundays, showing the weather conditions at 8 a. m., seventy-fifth meridian time (7 a. m., Central time), over the region of the Great Lakes and to the westward. Port Huron, Mich., is supplied with charts from Detroit. Vessel masters are cordially invited to call at any of the Weather Bureau offices for these charts or any other information they may desire in connection with the weather. The official in charge of the Weather Bureau office at Detroit, Mich., has been instructed to furnish a copy of all storm warnings, in addition to the weather maps, for the use of vessel masters passing Detroit. Arrangements have been made with the Post-Office Department whereby these warnings and weather maps will be delivered to the masters by the mail boat.

In case the mail boat does not have mail for each boat and the master desires information of the latest weather conditions, the following code of signals promulgated by the postmaster at Detroit may be used:

Signal to passing boats from United States mail boat for delivery of mail: (Blasts) one long (————); one short (—); one long (————).

Signal for steam vessels wanting mail boat to call for mail: (Blasts) one long (————); one short (—); one long (————).

Signals for sailing vessels requiring mail boat: White flag by day. Flashing bright light at night.

Signal from mail boat to large boats to check down: Three blasts from mocking-bird whistle.

Signal from rowboat belonging to mail boat when approaching vessels for delivery of mail: White flag in daytime. Swinging bright light at night.

For ordinary storm warnings the mail boat will display a red flag with black square center; and for warnings of severe or dangerous storms, two flags, red with black square centers. In the latter case the mail boat will deliver storm warnings to *all boats bound down*.

The Kendall Reporting Agency, at Port Huron, Mich., will deliver storm warnings to boats *passing into Lake Huron*.

Storm-warning displaymen at stations on the Great Lakes are authorized to telegraph for information regarding expected weather conditions in their vicinity whenever such information is requested by masters of vessels flying the American flag. From stations on Lake Superior, Michigan, or Huron these requests will be addressed to the Weather Bureau office, Chicago; from stations on Lake Erie or Ontario to the Weather Bureau office, Buffalo.

Masters of vessels of this class, whenever at a port on the Great Lakes where there is no Weather Bureau office or storm-warning station, may themselves telegraph for this information, observing the same rule as to territory as given above.

The telegram should be addressed: "Weather, Chicago," or "Weather, Buffalo."

These messages and the answers thereto will be at Government expense, but it is expected that the privilege thus granted will only be exercised when the information sought is regarded as necessary for the safety of the vessels concerned.

It is also expected that vessel masters who avail themselves of this privilege will make public the information obtained for the benefit of all vessels in their vicinity.

LIST OF STATIONS AND LOCATION OF FLAGSTAFFS AND STEEL TOWERS.

LAKE SUPERIOR.

Ashland, Wis.—J. G. Upthegrove.

Steel tower: Bay front, foot of Second avenue W., near junction with Front street. Electric lights.

Bayfield, Wis.—R. J. La Boute.

Steel tower: Eighty feet from water's edge, facing First street; 120 feet from intersection with Front avenue. Electric lights.

Deer Park, Mich.—Sara E. McGaw.

Flagstaff: Muskallonge Life-Saving Station, near mouth of Sucker River.

DULUTH, MINN.—H. W. Richardson, local forecaster.

Displays: Flags and electric lights. Headquarters Union Towing and Wrecking Company, Duluth.

Steel tower: Foot of Seventh avenue W. Allouez Ore Docks. Allouez Bay, J. C. Morrell, displayman and dock agent; steel tower on outer end of Dock No. 2.

Flags: Post-office building, First street and Fifth avenue, West Duluth. Evening Telegraph Building, 1017 Tower avenue, West Superior.

Eagle Harbor, Mich.—Alice Nolen.

Steel tower: On light-house reservation.

Grand Marais, Mich.—Mrs. Lena Truedell.

Steel tower: On Life-Saving Service reservation. Electric lights.

HOUGHTON, MICH.—Abc Wiesner, observer.

Steel tower: On roof of Weather Bureau office, Sheldon Building. Electric lights.

MARQUETTE, MICH.—H. R. Patrick, observer.

Steel tower: Marquette County Savings Bank building, southeast corner of Washington and Third streets. Electric lights.

Munising, Mich.—A. C. Hortho.

Flagstaff: On end of warehouse, Munising Railway Company's dock.

Ontonagon, Mich.—A. S. Follansbee.

Flagstaff: On post-office building.

Pequaming, Mich.—Charles Hebard & Son.

Flagstaff: Two hundred feet north of Hebard & Son's sawmill.

Ship Canal, Mich., Life-Saving Station.—Mrs. C. E. McCormick.

Steel tower: At Lake Superior end of ship canal.

SAULT STE. MARIE, MICH.—Alexander G. Burns, observer.

Flagstaff: Weather Bureau building. Electric lights.

Weather maps and storm-warning messages are placed in the canal office for masters of boats passing the canal, also with the superintendent of the Canadian Soo Canal. Barometers adjusted.

Superior, Wis.—E. A. Ostergren.

Steel tower: On outer end of Dock No. 2.

Two Harbors, Minn.—G. W. Watts.

Steel tower: At Ore Dock No. 2 and flagstaff at store of J. Schreiner & Co., corner of Poplar street and First avenue. Electric lights.

Washburn, Wis.—C. W. Layton.

Steel tower: On bay front. Electric lights.

Whitefish Point, Mich.—Mrs. Annie M. Carlson.

Steel tower: On light-house reservation, 667 feet east-northeast from tower, 31 feet north-northeast from fog warning No. 1.

LAKE MICHIGAN.

Beaver Island (St. James), Mich.—James McCann.

Steel tower: Church Hill.

Big Point Sable, Mich.—Mrs. Mary Lysaght.

Steel tower: On Life-Saving Service reservation, about 8½ miles from Ludington Harbor.

Charlevoix, Mich.—Miss Florence M. Smith.

Flagstaff: In front of telegraph office, near bridge and opera house. Electric lights.

CHICAGO, ILL.—Professor Henry J. Cox, Weather Bureau, Federal Building.

Flagstaffs: Auditorium tower. Life-saving station, Illinois Central pier No. 1.

Steel tower: On southwest corner of Life-Saving Service reservation, South Chicago. Electric lights.

ESCANABA, MICH.—W. P. Stewart, observer.

Steel tower: On roof of office building, corner Harrison avenue and Ludington street. Electric lights.

Frankfort, Mich.—Miss Amelia Morency.

Steel tower: Life-saving station. Electric lights.

Gladstone, Mich.—Paul H. Hammond. Electric lights.

- Flagstaff: Top of elevator at dock's "Soo Ry."
Glen Haven, Mich.—Eva E. Day.
 Steel tower: West end of Day's pier.
 GRAND HAVEN, MICH.—William H. Fallon, observer.
 Steel tower: Cutler House, corner Third and Washington streets. Electric lights.
 GREEN BAY, WIS.—F. W. Conrad, observer.
 Steel tower: On roof of Weather Bureau Office, Parmentier Block, 324 to 328 Washington street. Electric lights.
Harbor Springs, Mich.—V. A. Pool.
 Steel tower: Foot of Spring street.
Holland, Mich.—Mrs. Madalen A. Van Putten.
 Flagstaff: Life-saving station, Macatawa Beach.
Kenosha, Wis.—J. C. McNally.
 Steel tower: Near steamboat landing. Electric lights.
Kewaunee, Wis.—John Dishmaker.
 Flagstaff: Near harbor, close to telegraph office.
Ludington, Mich.—J. O. Ellison.
 Steel tower: Near Life-Saving Service station. Electric lights.
Macatawa, Mich.—Mrs. Jennie Van Weelden.
 Flagstaff: In front of life-saving station.
Mackinaw, Mich.—Chas. T. Dagwell.
 Steel tower: On grounds of the Lake Marine News Association. Electric lights.
Manistee, Mich.—F. V. Davis.
 Steel tower: Corner Pine and Second streets. Electric lights. Life-saving station, north side of entrance to harbor. Tower on west side of reservation. Electric lights.
Manitowoc, Wis.—T. C. Torrison.
 Steel tower: On river front, two blocks from lake. Electric lights.
Menominee, Mich.—L. C. Collins.
 Flagstaff: No. 1 engine house. Electric lights.
Michigan City, Ind.—Josephine R. Robb.
 Steel tower: At north end of Franklin Street Bridge. Electric lights.
 MILWAUKEE, WIS.—William C. Devereaux, local forecaster.
 Flagstaff: United States post-office building. Electric lights.
Milwaukee, Wis., life-saving station.—Mrs. Mary E. Olsen.
 Steel tower: Near life-saving station building. Electric lights.
Muskegon, Mich.—W. J. Miles.
 Steel tower: On grounds of Pere Marquette Railway Company. Electric lights.
Racine, Wis.—J. C. Dorchester.
 Steel tower: One block from lake on elevated ground. Electric lights.
St. Joseph, Mich.—Alberta E. Thomas.
 Steel tower: On bluff near Hotel Whitcomb, in Lake Front Park. Electric lights.
Saugatuck, Mich.—Frank H. Wade.
 Flagstaff: Post-office Building.
Sheboygan, Wis.—A. Leberman.
 Steel tower: Post-office block. Electric lights.
South Haven, Mich.—Mrs. Anna Donahue.
 Steel tower: On light-house reservation. Electric lights.
South Manitou Island.—Clara J. Pugh.
 Steel tower: Near Weather Bureau cable station. Electrical connection with mainland.
Sturgeon Bay, Wis.—E. W. Long.
 Steel tower: East side entrance to canal. Electric lights.

LAKE HURON.

ALPENA, MICH.—Frank Jermin, assistant observer.

Steel tower: Chisholm street near First. Electric lights.

Presque Isle Light.—Miss Kate L. Garrity.

Steel tower: Near light-house.

Bay City, Mich.—H. W. Perkins.

Flagstaff: On roof of Plum steel building, 1011 Water street.

Cheboygan, Mich.—Flora Marquette.

Steel tower: Near the steamboat dock. Electric lights.

Detour, Mich.—John F. Goetz.

Steel tower: On Dawson street, about 100 feet from hotel and telegraph office.

East Tawas, Mich.—John W. Tait.

Flagstaff: City flagstaff, shore end Commercial dock. Electric lights.

Mackinac Island, Mich.—H. L. Arnold.

Flagstaff: At end of Geo. T. Arnold's dock.

Middle Island, Mich.—Elizabeth A. Motley.

Steel tower: Near watchhouse.

Oscoda, Mich.—William McFarlane.

Steel tower: Twenty-five feet from shore line, 15 feet from dock driveway.

Ottawa Point, Mich.—Rebecca M. Small.

Steel tower: Life-saving station, repeating displays from East Tawas.

Pointe aux Barques, Mich.—Carrie M. Frahm.

Flagstaff: Eighty-four yards south of Pointe aux Barques light-house.

PORT HURON, MICH.—Edward A. Brown, observer.

Flagstaffs: United States custom-house. Electric lights. Kendall Marine Company, foot of Sarnia street.

Steel tower: Miller's coal dock. Electric lights.

Lakeview Beach life-saving station.—Mrs. E. J. Plough.

Flagstaff: Life-saving station.

Harbor Beach, Mich.—E. C. Reinelt.

Steel tower: High ground near F. and P. M. Railway depot.

Thunder Bay Island, Mich.—Celia E. Persons.

Steel tower: Southeast side of island near watchhouse.

LAKE ST. CLAIR.

DETROIT, MICH.—Norman B. Conger, inspector and marine agent.

Steel tower: On roof of Union Trust Building.

Flagstaffs: On United States mail boat. Smith's coal dock. Electric lights.

LAKE ERIE.

Ashtabula, Ohio.—C. M. Foust.

Steel tower: At east end of drawbridge. Electric lights. The steel tower is used for flag warnings only. The electric lights are displayed from a special support on the roof of Marine Block.

BUFFALO, N. Y.—D. Cuthbertson, local forecaster.

Steel tower: For electric lights.

Flagstaff: For flag displays, both on Prudential Building, Church and Pearl streets.

CLEVELAND, OHIO.—James Kenealy, local forecaster.

Steel tower: On new Government pier.

Flagstaffs: Society for Savings Building. Life-saving station, Charles E. Motley, jr.

Conneaut Harbor, Ohio.—W. B. Risley.

- Steel tower: On highest bluff at harbor. Electric lights.
 ERIE, PA.—C. F. von Herrmann, local forecaster.
 Steel tower: At Soldiers' Home grounds.
 Flagstaffs: Federal building. Carnegie dock. Life-saving station. Soft-coal docks. Electric lights.
Fairport Harbor, Ohio.—Melvin L. Root.
 Steel tower: On bluff 600 feet from Grand River. Electric lights.
Huron, Ohio.—J. S. Barram.
 Steel tower: At foot of Main street, between lake shore and river bank. Electric lights.
Kelleys Island, Ohio.—J. B. Reinheimer.
 Steel tower: On hill near steamboat wharf, in front of telegraph office.
Lorain, Ohio.—T. H. Tristram.
 Steel tower: West end drawbridge between River and Broadway streets. Electric lights.
Marblehead, Ohio, life-saving station.—Mrs. Martha M. Griesser.
 Steel tower: On grounds of the Kelleys Island Line and Transport Company.
 Flagstaff: Twenty feet north of life-saving station.
Put in Bay, Ohio.—Henry Fox.
 Steel tower: Fox & Son's dock.
 SANDUSKY, OHIO.—E. H. Nimmo, observer.
 Flagstaff: Post-office building, corner of Columbus avenue and Market street. Electric lights.
Stony Point, N. Y. (West Seneca, N. Y.).—Capt. T. C. Jacobsen.
 Steel tower: One hundred feet north of the southern end of the Government break wall. Electric lights.
 TOLEDO, OHIO.—W. S. Currier, local forecaster.
 Flagstaff: Nicholas Building, northwest corner Madison and Huron streets. Electric lights.
Tonawanda, N. Y.—T. L. O'Connor.
 Steel tower: State grounds.

LAKE ONTARIO.

- Cape Vincent, N. Y.*—V. M. Rice.
 Steel tower: On United States Fish Commission wharf.
Charlotte, N. Y.—Cassie E. Gray.
 Steel tower: Life-saving station.
Fort Niagara, N. Y., Life-Saving Station.—Mrs. Annie Clemons.
 Steel tower: Twenty-seven feet west of life-saving station, east side of entrance to Niagara River.
North Fair Haven, N. Y.—A. M. Eldridge.
 Steel tower: Near custom-house.
Ogdensburg, N. Y.—E. J. Dinneen.
 Steel tower: Center of Caroline street, about 200 feet from North Water street.
 OSWEGO, N. Y.—J. G. Linsley, observer.
 Flagstaffs: Weather Bureau office, custom-house, West Oneida street, between West First and Second streets. Oswego Yacht Club.
 Steel tower: Twenty-five feet southeast of life-saving station. Electric lights.
 ROCHESTER, N. Y.—L. M. Dey, local forecaster.
 Flagstaff: On Cutler Building. Warnings displayed by J. G. and J. W. Cutler, displaymen.
Sacket Harbor, N. Y.—Clark M. Stearne.
 Steel tower: On high bluff at end of Main street.
Sodus Point, N. Y.—M. M. Farrell.
 Steel tower: Northern Central Railroad Co.'s grounds.

CANADIAN GREAT LAKES STORM-WARNING STATIONS.

LIST OF PLACES ON THE GREAT LAKES AT WHICH STORM WARNINGS ARE DISPLAYED BY THE METEOROLOGICAL SERVICE OF THE DOMINION OF CANADA, R. F. STUPART, TORONTO, ONTARIO, DIRECTOR.

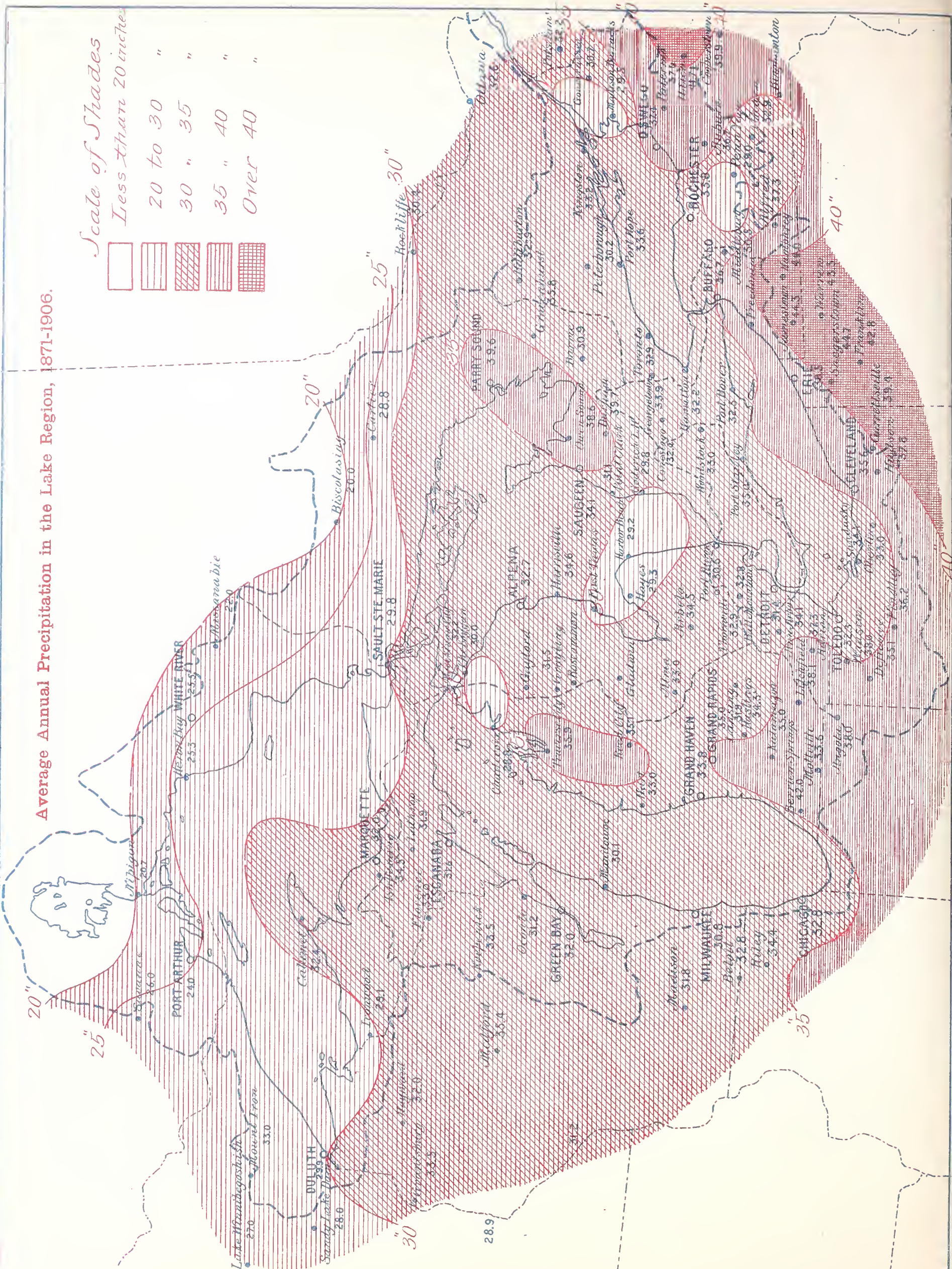
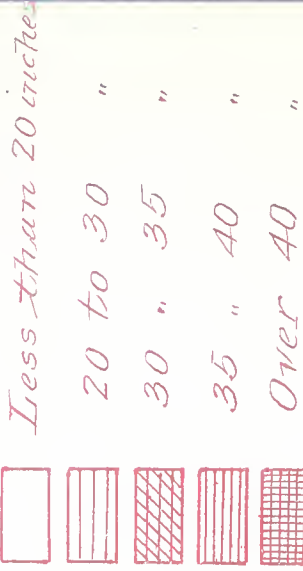
- Fort William*.—Signal mast adjoins Fort William Rowing Club.
Port Arthur.—Signal mast on the town end of the Government wharf.
Sault Ste. Marie.—Signal mast on Government wharf.
Tobermory.—Signal mast on the point between the two harbors.
Depot Harbor.—On Rocky Light Point, a little to east of elevators.
Parry Sound.—Signal mast on a high ridge of land overlooking harbor.
Midland.—Signal mast on ridge in east, adjoining the town.
Collingwood.—Signal mast in line with piers and west of railway tracks.
Owen Sound.—Signal mast on the west side of harbor opposite C. P. R. station.
Sarnia.—Signal mast on the town wharf adjoining waterworks property.
Kincardine.—Signal adjoining east wharf.
Goderich.—Signal mast on bluff near light-house.
Saugeen.—Signal mast at the corner of High and Lake streets.
Bayfield.—Signal mast overlooking harbor.
Pelé Island.—Signal mast near the light-house on the north point.
Port Stanley.—Warnings sent out and posted, but no signal displayed.
Port Dover.—Signal mast on wharf opposite Grand Trunk Railway station.
Port Colborne.—Signal mast on the canal bank.
Port Burwell.—Signal mast on hill overlooking harbor.
Amherstburg.—Signal mast on the wharf near waterworks wharf.
Port Dalhousie.—Signal mast on the canal bank.
Burlington.—Signal mast at the light-house near the swing bridge.
Oakville.—Signal mast on the bluff just above the wharf.
Port Credit.—On the lake shore.
Toronto.—Signal masts at Queen's wharf and also adjoining fog-signal house at Eastern gap.
Port Hope.—Signal mast on the wharf.
Coburg.—Signal mast on the town end of wharf.
Deseronto.—Signal mast at the end of railway wharf.
Prinyer.—Signal mast inside Prinyer Cove.
Kingston.—Signal mast on water front a little to westward of steamboat wharf.

Wind-Barometer Table for the Great Lakes.

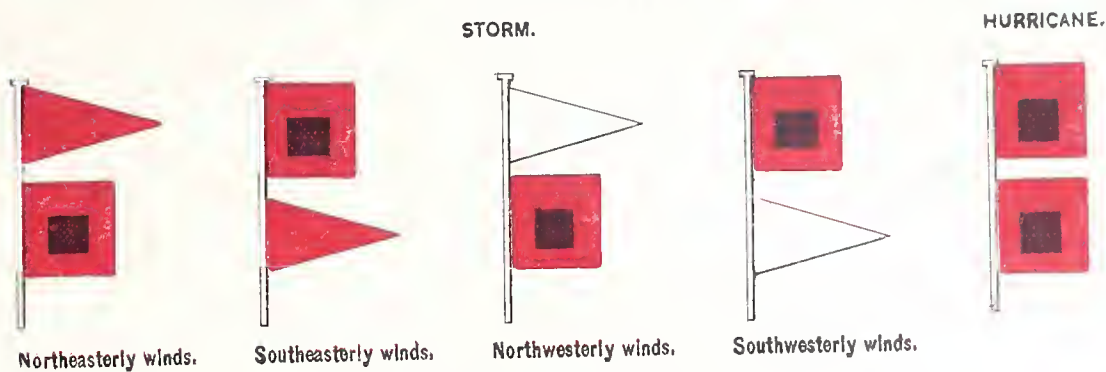
Height of barometer (lake level).	Direction of wind.	Character of weather and wind indicated.
29.40 to 29.60, and steady.....	West.....	Fair, slight changes in temperature, gentle to fresh winds.
29.40 to 29.60, rising.....	do.....	Fair, cooler, fresh west to northwest winds.
29.40 to 29.60, falling.....	South.....	Warmer, increasing southerly winds.
29.60, or above, falling rapidly.....	East to south.....	Warmer, rain or snow within 36 hours, increasing east to southeast winds.
29.60, or above, rising rapidly.....	West to north.....	Cool and clear, quickly followed by warmer, variable winds.
29.60, or above, steady.....	Variable.....	No immediate change, but winds will go to south inside of 36 hours.
29.40, or below, falling slowly.....	South to east.....	Rain or snow, increasing easterly winds.
29.40, or below, falling rapidly.....	do.....	Rain or snow, high easterly winds, followed within 48 hours by clearing, cooler, west to northwest winds.
29.40, or below, rising slowly.....	South to west.....	Clearing, colder, fresh to brisk west to northwest winds.
29.20, or below, falling rapidly.....	South to east.....	Severe storm of wind and rain, and wind shifting to northwest within 36 hours.
29.20, or below, falling rapidly.....	East to north.....	Severe northeaster, with heavy rain or snow, and winds backing to ^{W-S} northwest.
29.20, or below, rising rapidly.....	Going to west.....	Clearing and cooler, probably cold wave in winter.

Average Annual Precipitation in the Lake Region, 1871-1906.

Scale of Shades



STORM AND HURRICANE WARNING FLAGS.



EXPLANATION.

Storm Warning Flags.—A red flag, with a black center, indicates that a storm of marked violence is expected.

The pennants displayed with the flags indicate the direction of the wind: red, easterly (from north-east to south); white, westerly (from southwest to north). The pennant above the flag indicates that the wind is expected to blow from the northerly quadrants; below, from southerly quadrants.

By night a red light indicates easterly winds, and a white light above a red light, westerly winds.

Hurricane Warning.—Two red flags, with black centers, displayed one above the other, indicate the expected approach of tropical hurricanes, and also of those extremely severe and dangerous storms which occasionally move across the Lakes and northern Atlantic Coast.

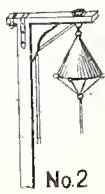
Hurricane warnings are not displayed at night.

CANADIAN STORM SIGNALS.

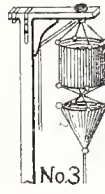
DAY SIGNALS.



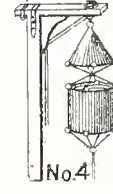
No. 1



No. 2



No. 3



No. 4

Day signal.	If displayed on Lakes Superior, Erie, or Ontario indicates—	If displayed on Lake Huron or in Georgian Bay indicates—
No. 1.....	A moderate gale is expected at first from an easterly direction.	A moderate gale is expected at first from a southerly direction.
No. 2.....	A moderate gale is expected at first from a westerly direction.	A moderate gale is expected at first from a northerly direction.
No. 3.....	A heavy gale is expected at first from an easterly direction.	A heavy gale is expected at first from a southerly direction.
No. 4.....	A heavy gale is expected at first from a westerly direction.	A heavy gale is expected at first from a northerly direction.

The cone when displayed alone indicates that it is expected that the wind will attain a velocity of 25 miles an hour but will not exceed 35 miles, and it is not intended to indicate that an ordinary well-found vessel should stay in port, but is simply a warning that strong winds are expected from the quarter indicated.

The drum will always be hoisted when the velocity of the wind is expected to exceed 35 miles an hour.

NIGHT SIGNALS.

The Night Signal corresponding to Day Signals Nos. 1 and 3 is a red light.

The Night Signal corresponding to Day Signals Nos. 2 and 4 is a white light above a red light.

